COMPUTING FOR BUSINESS AND HOME

INTERFACE AGE™

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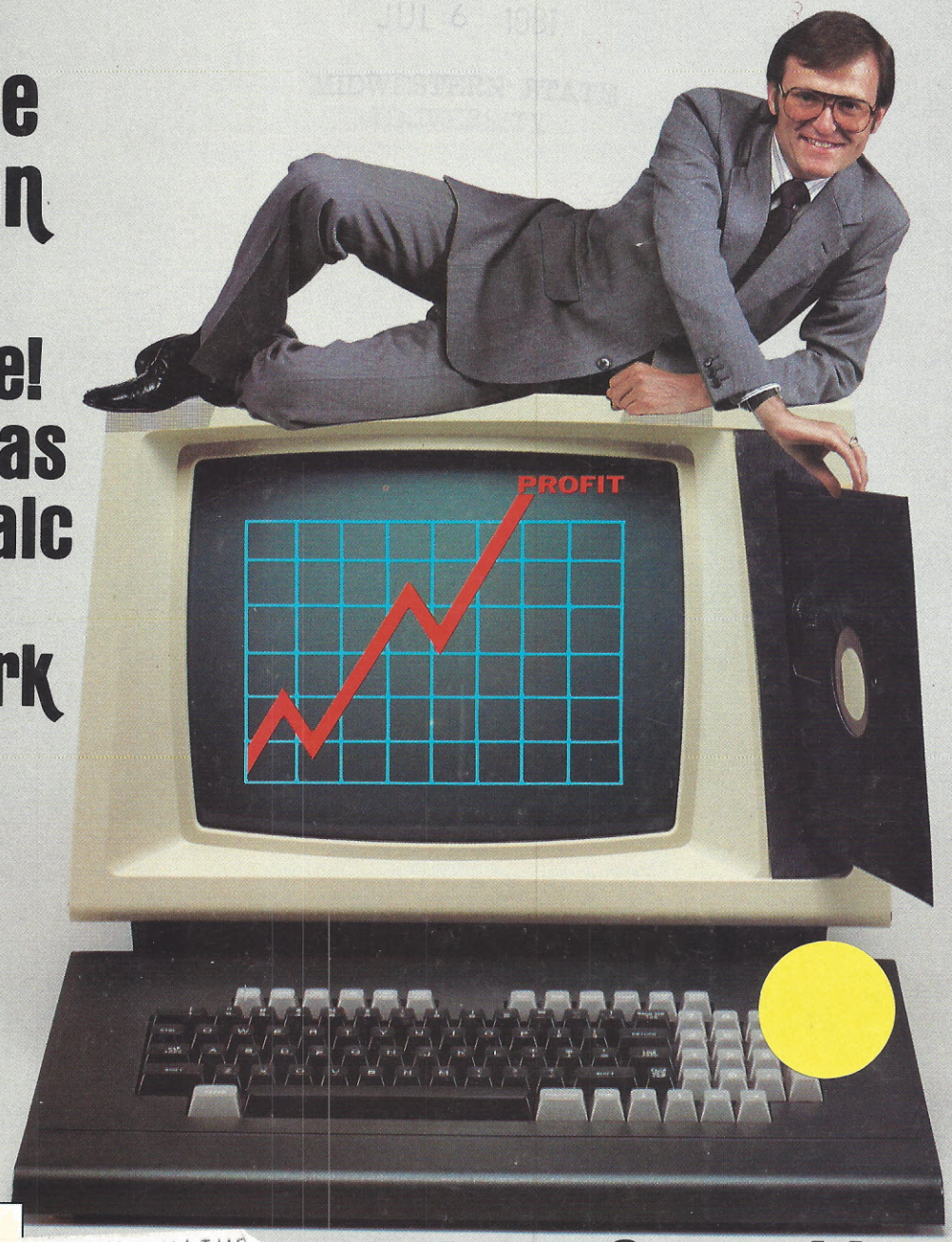

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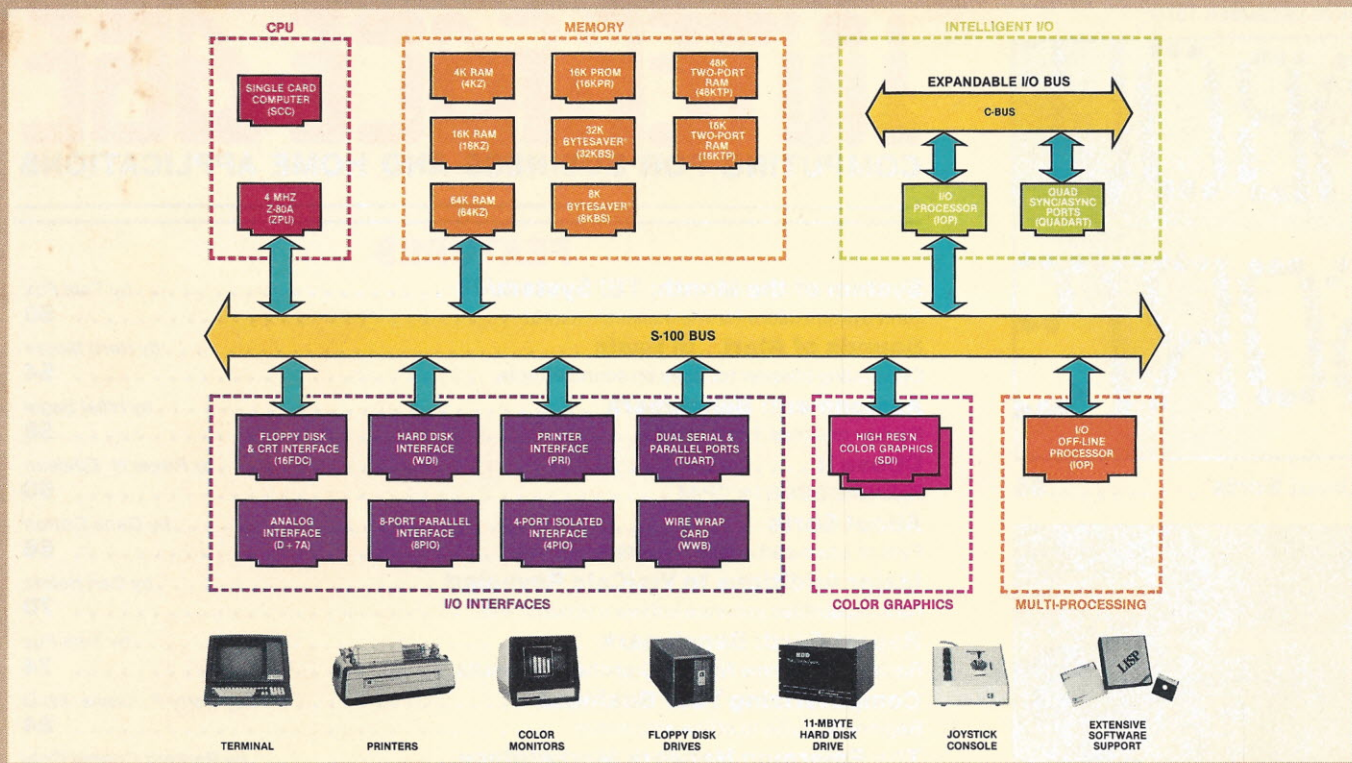

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SINCE DECEMBER 1975

AUGUST 1981

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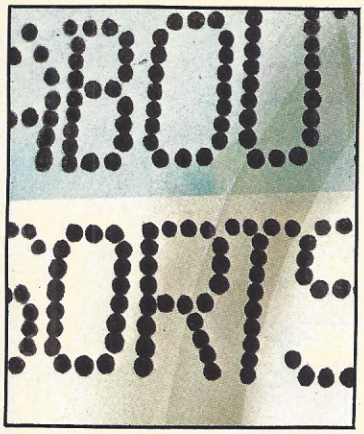
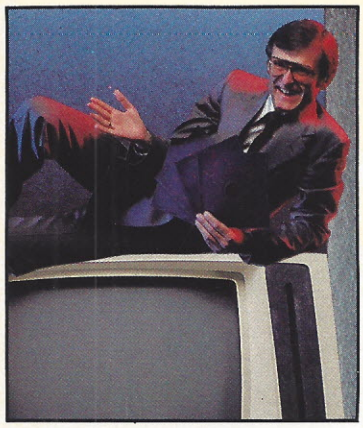


About Sorts 66



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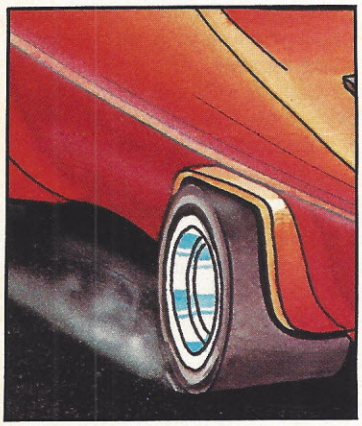

Report Card: Benchmark 74

Cover: Terminal keyboard courtesy of Lear Siegler Inc., Anaheim, CA
Photography: Don May
Disk drive modification added by Fino Ortiz, Art Director
Model: Colin Cato

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COLUMNS

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Contact authors of monthly columns by writing to them at INTERFACE AGE, P.O. Box 1234, Cerritos, CA 90701 in care of their respective columns.

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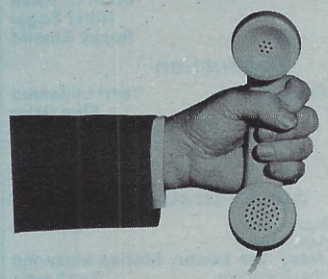

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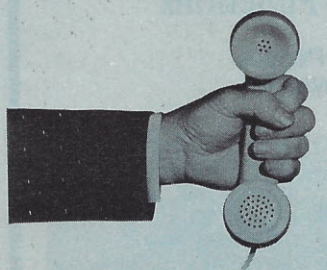

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Advertising

Boston **Dick Green**
7 Lincoln St., Wakefield, MA 01880
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Japan **Tomoyuki Inatsuki**
Trade Media Japan Inc., R. 212 Azabu Hts., 1-5-10,
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Telephone: (03) 585-0581 Telex: J28208

Interface Age Europe

Director, European Operations **H.J. Grohmann**
Advertising Manager **Sylvia Stier**
Dahlienstr. 4, D-8011 Munchen-Vaterstetten
West Germany
Telephone: 08106/7396

International Newsstand Distribution

Director **Lew Ullian**
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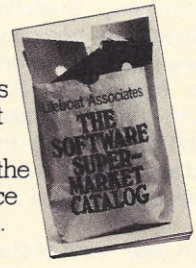

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The National Computer Conference, sponsored by the American Federation of Information Processing Societies (AFIPS) and four other large computer organizations has been with us, in one form or another, for many years. This year, the NCC was held at McCormick Place, a grand exhibition palace by the shores of Lake Michigan, squeezed up against the spectacular skyline of downtown Chicago.

Four scant days in May were alloted for dedicated NCC visitors to: 1) attend 250 hours' worth of technical sessions, 2) trek a quarter million square feet of show space spread over three great halls, 3) peruse the products of 562 exhibitors, all eager for attention, 4) joust with 73,000 other information-hungry attendees for elbow room and hot dogs and 5) stop by the *Interface Age* booth for a free copy of June's Computer Language issue. All this couldn't be done in such a short time; the wise didn't even try.

All this grandeur was *in addition* to a Personal Computing Festival, itself offering a full three-day schedule of technical sessions and separate scaled-down display area. The PCF has always been a strangely unsatisfying appendage to the NCC, an experiment never fulfilled. 1981 was its last year of struggle, and we think the demise is a merciful one. The technical sessions were largely sales demonstrations of available microcomputer products (mostly software). This is in sharp contrast to the mainstream of the NCC get-togethers, where systems designers spoke earnestly of machinery we might see year-after-next and beyond.

The Personal Computing exhibit area had more the flavor of a high-school science fair, where products of mediocre individual ingenuity were nervously hawked. It was not the best showpiece for the current exciting state of personal computer development. So the NCC organizers are abandoning personal computing ("integrating it into the main event" in their words). Perhaps it's for the best. Trade shows such as the West Coast Computer Faire treat the phenomenon of personal computing with a lot more understanding than AFIPS; the giant has finally admitted to being outclassed in this area, at least.

The entertainment highlight of the Personal Computing Festival was the commentary from the floor following Adam Osborne's keynote speech "A New Direction in Personal Computing." Many attendees zeroed in on Adam's curious methods for marketing the forthcoming super-low-cost Osborne I microcomputer. His policy of accepting cash deposits against a promise of future deliveries, in particular, drew fire. The protesters seemed to remember pointed admonishments against this very practice by Osborne himself in his *From the Fountainhead* column (formerly carried in this magazine).

What was new at NCC 1981? These caught our eye:

Color printers. Relatively low in cost, these devices bring to hard copy what color CRT terminals have offered to imaginative computer users for some time. The new printers utilize two technologies: colored ribbons and ink jets. All are of the dot matrix style, and offer high-density graphics as a part of the package. The simplest uses an ink ribbon stitched end-to-end with different color segments, reeled at high speed in front of the print head for timely strikes of the print hammers. Another utilizes a ribbon impregnated with a half-dozen thin stripes of colored ink. A clever mechanism shifts the ribbon up and down with a finesse that would be the envy of any old Underwood typewriter. The most elaborate example employs multiple jets of colored ink that appear to be mixed in a palette of thin air as the droplets accelerate silently towards the paper.

Cheap terminals. A price war for CRT terminals instigated last year by TeleVideo has spurred new products by Adds, Lear Siegler, Soroc and others. The new generation of terminals is not only lower in cost, but offers considerably more in the way of intelligence than today's common "dumb" terminals —thanks to a dedicated microprocessor in each. Adds emerged the price winner with a $650 unit; TeleVideo rejoined with an even lower ticket on a forthcoming model.

High-quality dot matrix printers. Owners of the popular Epson and Okidata personal computer printers won't be surprised by this one, but the news is that almost all dot-matrix manufacturers were displaying "enhanced mode" devices. These printers make multiple passes over the print line to simulate the appearance of a fully-formed character image. They haven't yet achieved the quality of the old standby Diablo, Qume and NEC devices, but they're getting closer.

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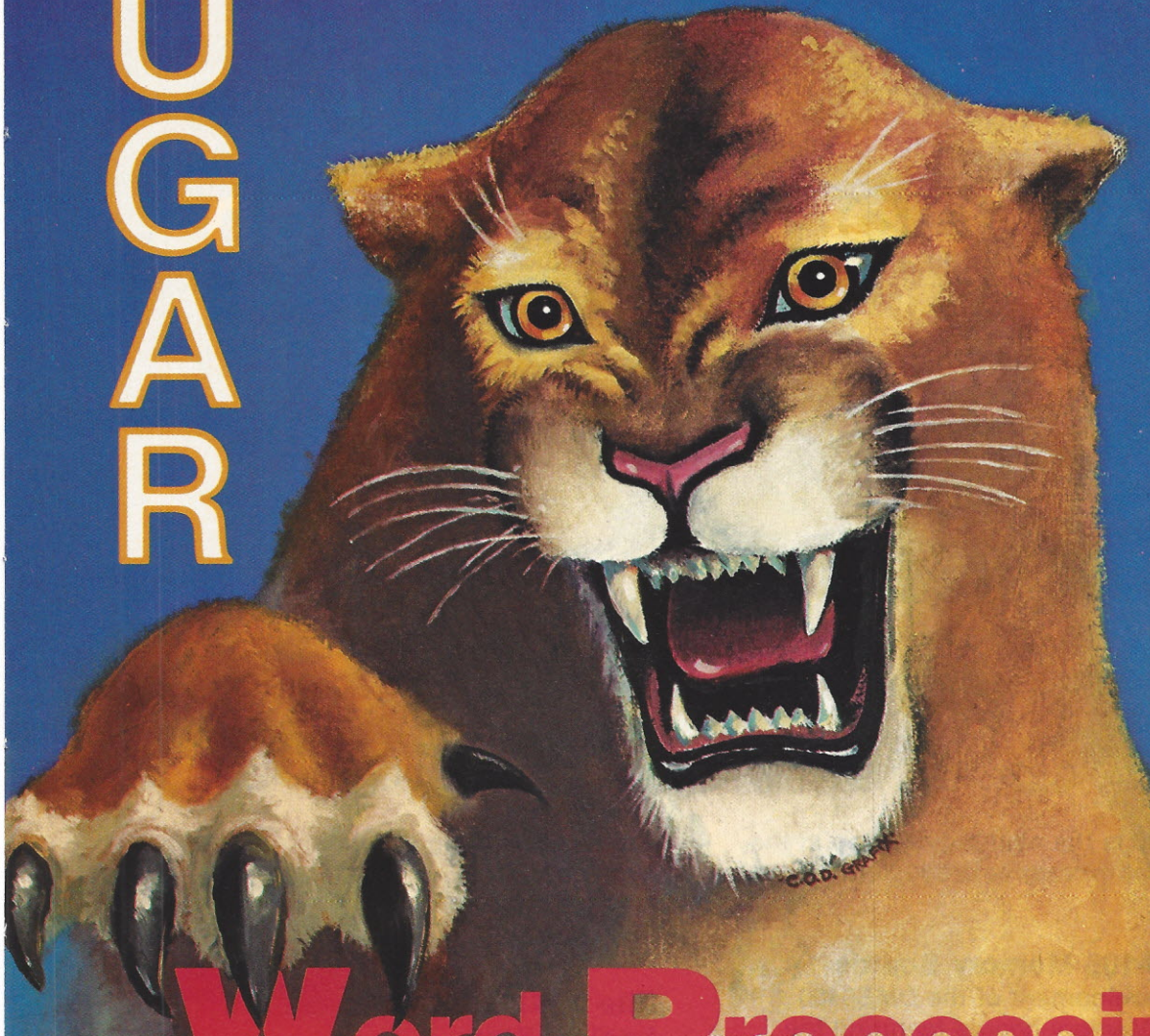

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ANNOUNCING

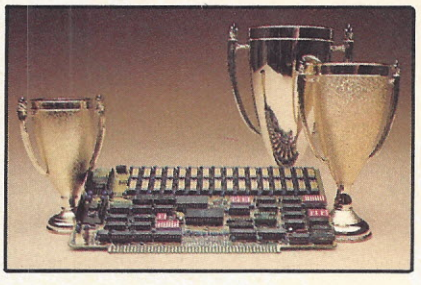
A Major Breakthrough

The SYSTEM 2800

The System 2800 is the next logical step in the continuing line of innovative products from the Systems Group.

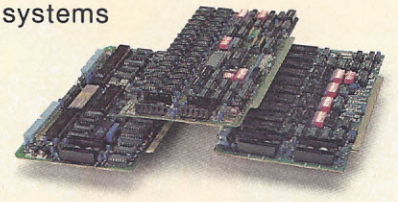
Unbeatable S-100 Memory Boards

First was the development of the DMB6400 series of S-100 Memory boards featuring the innovative Bank Select switching technique. This enables users to software select up to four totally independent memory banks per board.



The 2nd Generation

Then came the 2nd Generation of IEEE S-100 COMPATIBLE Z80 PROCESSORS, FLOPPY DISK CONTROLLERS and SERIAL I/O BOARDS. Each has been designed for single user, multi-user or network operating systems such as CP/M®, MP/M™, CP/Net™ and OASIS™.



The Next Logical Step ...

We challenged our design team to create an innovative yet competitive system utilizing our existing line of field proven, dependable S-100 boards. The result: a highly reliable, quality built, state of the art microcomputer that gives you the cost/performance edge you need to be a leader in your field.

The System 2800 comes with a choice of operating systems: CP/M with an enhanced CBIOS for single user systems and either MP/M or OASIS for multi-user, multi-tasking systems. MP/M is available with either a standard or

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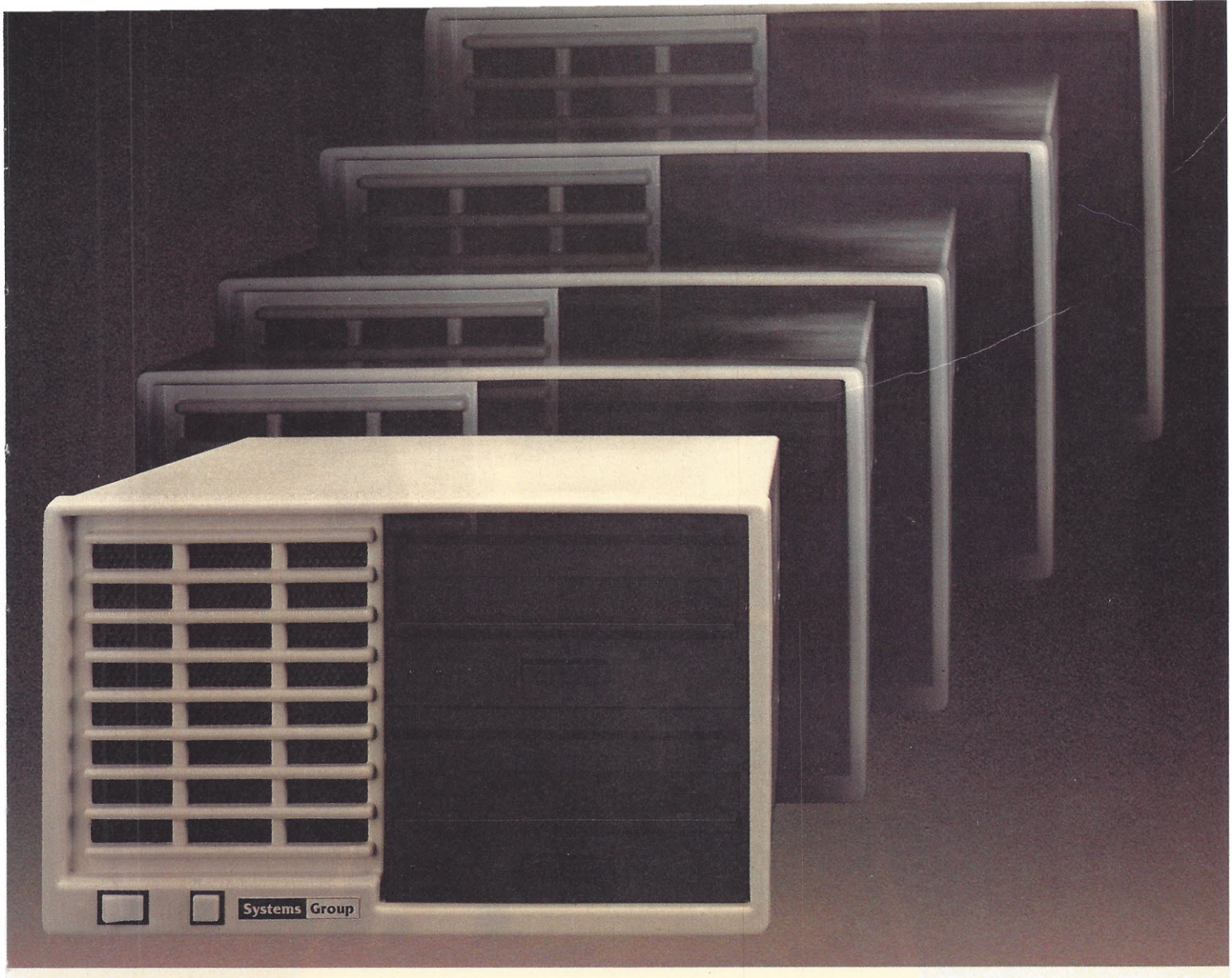

enhanced XIOS. The CP/M based System 2800 provides improved diagnostic reporting capability and increased sector sizes of 1024 bytes yielding disk performance throughput increases up to 400% over standard unblocked systems.

The enhanced multi-user, multi-tasking MP/M based System 2800 provides the same advanced features as CP/M. In addition, this interrupt driven implementation can offer performance throughput increases up to 2000% thru extensive disk buffering for applications requiring a large number of disk accesses.

Also available is the OASIS operating system with ISAM files, automatic record locking and multiple-user print spooling.

All operating systems are available in either floppy or hard disk configurations. The disk drive selection includes single or double sided, double density 8-inch floppies with up to 2.52 megabytes of formatted storage per system, expandable to 5.04 megabytes, and an 8-inch 10 megabyte winchester hard disk.

Cost Effective Reliability

Dealers, OEM's and System Integrators share many common needs. Not the least of these is dependable products. That's why we back our System 2800 with our established reputation for high quality products, superior support, prompt and courteous service, and a one-year warranty.

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Ultra high-density floppies. Two manufacturers showed prototypes of floppy disk drives that can hold an unprecedented amount of information on a single 8-in. floppy diskette. PerSci promises 5M bytes per diskette; Iomega an incredible 10M bytes. Don't hold your breath, however. Neither is promising quantity production before mid-1982 at the earliest.

Microfloppies. 3.5-in diameter floppy diskettes that can slip into your pocket and hold over 400K bytes of data are around the corner, according to a pair of Japanese manufacturers. The two designs are, unfortunately, not compatible with each other.

Multi-micro networks. An exciting idea that may just burst the performance bonds of the tiny microprocessor, co-operative arrays of nearly independent CPUs, can accomplish an impressive amount of work in a short time. The idea is far from new, but we saw several well-developed working examples at the show. Corvus' Omninet, a slightly scaled-down Ethernet implementation, evidenced a careful, well thought-out design. TEI's System/48 and Tele-Video's new family of microcomputers feature multi-microprocessor networks within a single enclosure.

32-bit micro. Intel showed its long-awaited 4032 microprocessor, 32 bits wide and sure to be a trend-setter. The most amazing features are deeper: a capable operating system imbedded in silicon and a way to connect multiple chips into intimate shared arrays for unprecedented number-crunching power. Except for a few carefully controlled prototypes, the 4032 isn't here quite yet. We must wait until late 1982 or longer before we see this engine in a computer for general consumption.

Japan, Inc. Here's a list of companies with attractive desk-top designs that need only American software and American distribution before they become as familiar as Datsuns and Toyotas: Fujitsu, C. Itoh, Mitsubishi, Nippon, OKI, Panasonic, Sharp, Sony and Toshiba. Watch out, world.

NCC 1981—quite a show. Join us next year at the Houston Astrodome for NCC 1982. We might have just recovered from this year's bash by then. □ —*TF*

LETTERS

Mail viewpoints

I would like to comment on the "Computers by Mail" article by Tom Fox (IA Mar 81) and the follow-up reaction by certain computer stores who do not feel your publication should report on the mail order market ("Editor's Notebook" Jun 81). We have been selling *Interface Age* as well as a wide variety of other publications along with our small computers for several years. We will continue to sell the magazine, so that our customers will have the widest possible base of information from which to make their computer-related decisions. This is the point I would like to make to computer dealers: Let the customer decide. Don't consider your customers dumb and blind. Censoring what publications you will sell won't solve any problems. It can only reduce a store's credibility.

Bob Williams
Williams Radio and TV
Jacksonville, FL

As an independent computer retail store, I do not just sell computers. My job is to help people find a solution to a problem. Mail order houses are *only* selling merchandise. They *cannot* give follow up support. They *cannot* answer a lot of questions at 10 o'clock at night, among many other things. It angers me that local shops feel the need to "compete" with the mail order houses. Too many retail shops are taking the same attitude as the mail order houses...only selling merchandise. It is up to local computer stores to educate the public, not drive them to mail order houses. If the end user cannot get support from the local dealer, the mail order houses will continue to dominate the sales of computers and computer products.

Carol G. Seran
Academy Computers
Colorado Springs, CO

Your account of the ComputerLand dealers' campaign made me angry. The dealers' actions are worse than wrong; they are stupid. Any organization that tries to give a publication a black eye usually winds up with a broken arm.

Edward Swain
Austin, TX

Being new to computers (the owner of an Atari 800), I need service. Computer magazines can provide me service only if they can feel free to print whatever is on their mind. If ComputerLand stores likewise provided a service, they would have no need to fear any publication, whether it was as unbiased as the Tom Fox article, or even if an article were totally biased. If more computer stores were operating in a businesslike manner, had business-oriented computer salesmen (and not merely computer specialists), and were as considerate six months after a sale as they were during the sales process, computer stores would retain customer loyalty and further referrals.

Frank A. Hahn
Chicago, IL

I found the article to be entertaining, well-written and even-handed, with an appropriate nod to non-mail order sources. Mail order is a convenient alternative for buyers of computer products and, therefore, a subject of interest to your readers.

P.W. Michels
Holmdel, NJ

The article properly summed up the pros and cons of the mail order computer industry...as viewed by the potential end user.

Robert N. Harris
Santa Clara, CA

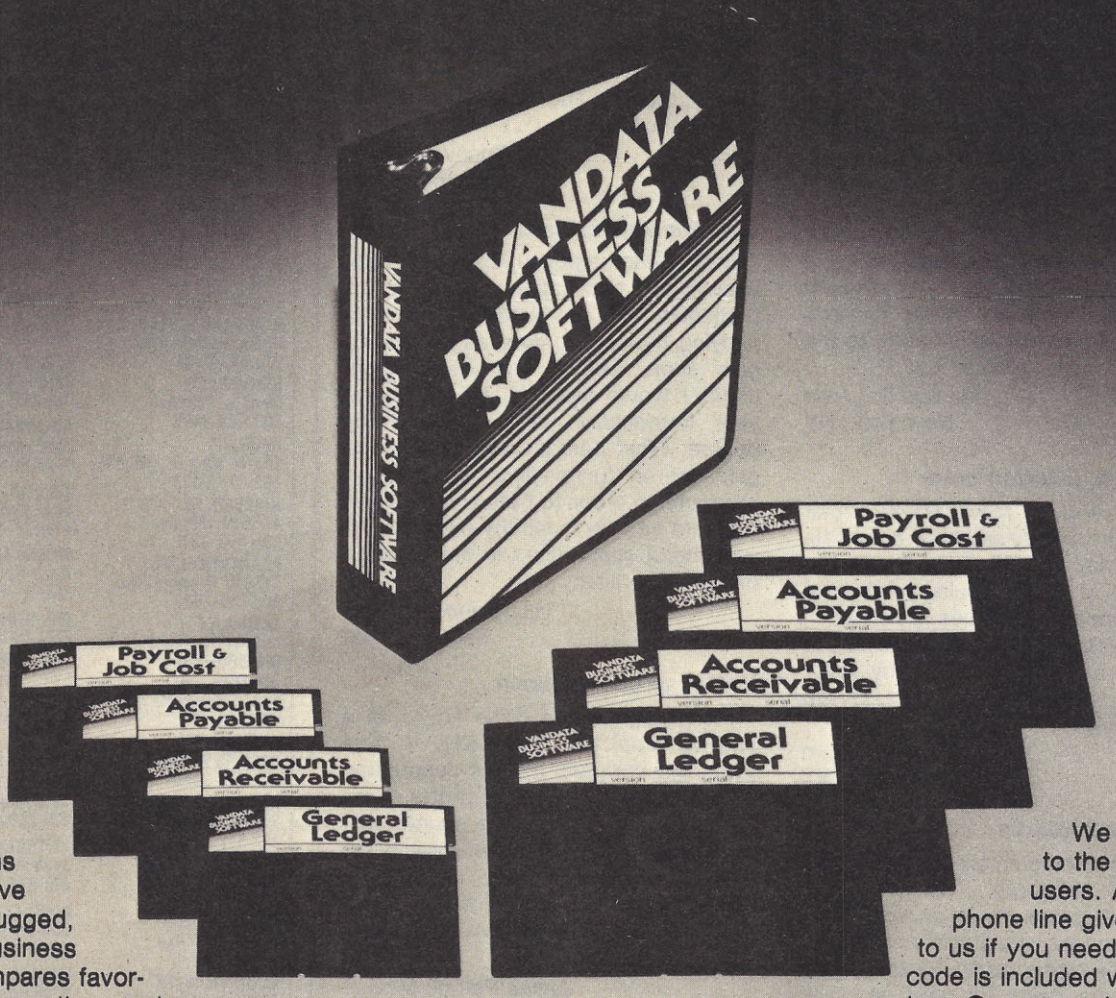
Off the mark

The following comments pertain to the applicability of benchmark tests to microcomputer systems in general and to your Cromemco report ("Assignment Benchmark" IA Feb 81) in particular. The validity of benchmark results for microsystem users is questionable, since relatively few of these users actually run the same program on a continuing, daily basis. In fact, it is likely that the time saved by microsystem users through the use of their systems for truly productive work is far less than the time spent developing their programs. While the speed of operation of a microsystem may be intriguing, the ease of use is probably far more meaningful, particularly in a business environment.

David Rose
Tokyo, Japan

I read the April installment of "Assignment: Benchmark" by Hillel Segal with some interest. I do not own a Vector Graphics computer, but I do own a Micropolis dual floppy subsystem. I perceived a certain bias in the author's attitude toward "performance." I don't understand his concept of "enough storage for serious computing." Consider: the average (single-density) 8-in. floppy holds 250K. The average (double-density) 5.25-in. floppy holds about 160K. Micropolis Mod II drives hold 315K, and the new double-sided Micropolis drives hold 630K. This is on a par with the Tandon drives mentioned in

Account on it.



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The checks and statements fit standard forms readily available from mail-order forms suppliers. You have your choice of a number of different formats.

We are committed to the support of our users. A tech support phone line gives you access to us if you need it. Full source code is included with every system. Our money-back guarantee speaks for itself.

Minimum requirements are 48K RAM, CP/M™ or CDOS, CBASIC2™, a CRT, and a 132-column printer. We can provide standard 8", NorthStar 5" double-density, or Heath/Zenith 5" diskettes — call for availability of other formats. The price is $295 per system, or $995 for the complete set of four.

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such glowing terms in the article. Four drives on a Micropolis controller, at 315K per drive, is not trivial storage. If that isn't enough, you can install a second controller, for another four drives. By comparison, the drives in the Cromemco System Two, with a capacity of 368K total, were excused on the grounds that the Z-2H is available, with 10M-byte storage. If you go that route, you might as well spend the same amount and buy the Micropolis rigid disk for 32M-byte storage. I am sorry if I misinterpreted the author's intent, but I think he sometimes operates in an ivory tower. Segal seems to care only about packaged systems, put together by a single vendor. This is fine, but packaged systems can only go as far towards satisfying the consumer's needs as the vendor's concept allows.

Marcus S. Lewis
New York, NY

Horse of a different color

I purchased a 16K TRS-80 color computer in January and have done little else but play with it since. There are quite a few of us that would be delighted to see more quality games like those in Al Baker's *Game Corner* column. As you must know, there aren't many color computer programs available. Keep them coming.

Dennis Anderson
Brooklyn, NY

Pertinent REMarks

Your comments on program REMarks ("Editor's Notebook", IA May 81) deserve attention. In my opinion, most Basic languages would suffer significant slow downs with a remark for every line. I take some pains to keep as many remarks out of the execution path as possible. Writing the remarks as your code isn't far enough. In many instances, a functional block of code starts out life as a remark line only. This is very effective in overcoming the "blank screen syndrome" many programmers suffer from.

John McCarron
Phoenix, AZ

Efficient secretary

Re: "Word Processing Apple-ications" by Robert Moskowitz (IA May 81), which compared six word processors for the Apple II. Since Sept. 1980, I have been using a word processing package created and developed by John Riskin, owner of Personal Business Systems in Minneapolis. As I am really enthusiastic about the program, the Executive Secretary, I was naturally curious as to whether one of the better known word processing programs was better than the one I'm using. I'm very happy to say that I want to stick with the Executive Secretary. It is an extremely easy-to-learn, yet very complete word processor. The keyboard commands are very simple and logical, editing is a snap and it can be used as either a 40 or 80 column board. The documentation is also very complete.

Sunny Edwards
Minneapolis, MN

Vote for applications

May I encourage your continued publication of application programs. In particular, I like the explanation accompanying these programs, as it tends to give some insight into the process itself. I would also like to encourage your introduction of a home study course. What I am looking for is some guidance on "unravelling" complicated programs in order to better understand them, to be able to modify them, and to use useful subroutines in the creation of new programs.

H.L. Daneman, P.E.
Santa Fe, NM

Matter of convenience

I enjoyed reading "The Micro as a Writing Tool"(IA May 81). I was especially intrigued by your description of the Waltek Engineering printer driver for the Diablo 1620. This sounds just like a program I have been meaning to write ever since I got my Diablo. However, at $29.95, I would much rather buy it than spend that much of my time writing it.

James Patrick McGee
Houston, TX

Reader interface

I'm a computer programmer but know nothing about the hardware. I'm looking for a personal system that has high resolution color graphics and some scientific applications at an affordable price ($2,000 or less)—without printer or video display (if it can be hooked up to a TV). I'd greatly appreciate a system recommendation and suggestions on which peripherals should be used in order to have a ready-to-run system. What modem should I use to connect the computer to a time-sharing system?

Tim Tang
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The Heath/Zenith 19 Smart Video Terminal gives you all the important professional features, all for under $700.* You get the flexibility you need for high-speed data entry, editing, inquiry and transaction processing. It's designed to be the backbone of your system with heavy-duty features that withstand the rigors of daily use.

Standard RS-232C interfacing makes the 19 compatible with DEC VT-52 and most computer systems. And with the 19, you get the friendly advice and expert service that makes Heath/Zenith a strong partner for you.

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Z-80 microprocessor-control makes the Heath/Zenith 19 capable of multitude of high-speed functions. It's the only terminal with ROM source code readily available.

Complete ASCII character set including upper case, lower case with descenders, and special graphic symbols.

80 character by 24 line format, plus 25th line for operator messages and prompts.

Professional quality keyboard, standard typewriter layout, 72 keys, including 12 special function keys.

Insert and delete character or line plus erase to end of line and end of screen make the 19 ideal for sophisticated editors like WORDSTAR.

Cursor and special functions are accessible by keyboard or computer, using either DEC VT-52 or ANSI Standard protocols.

Keypad in calculator format permits fast, easy entry of numeric data.

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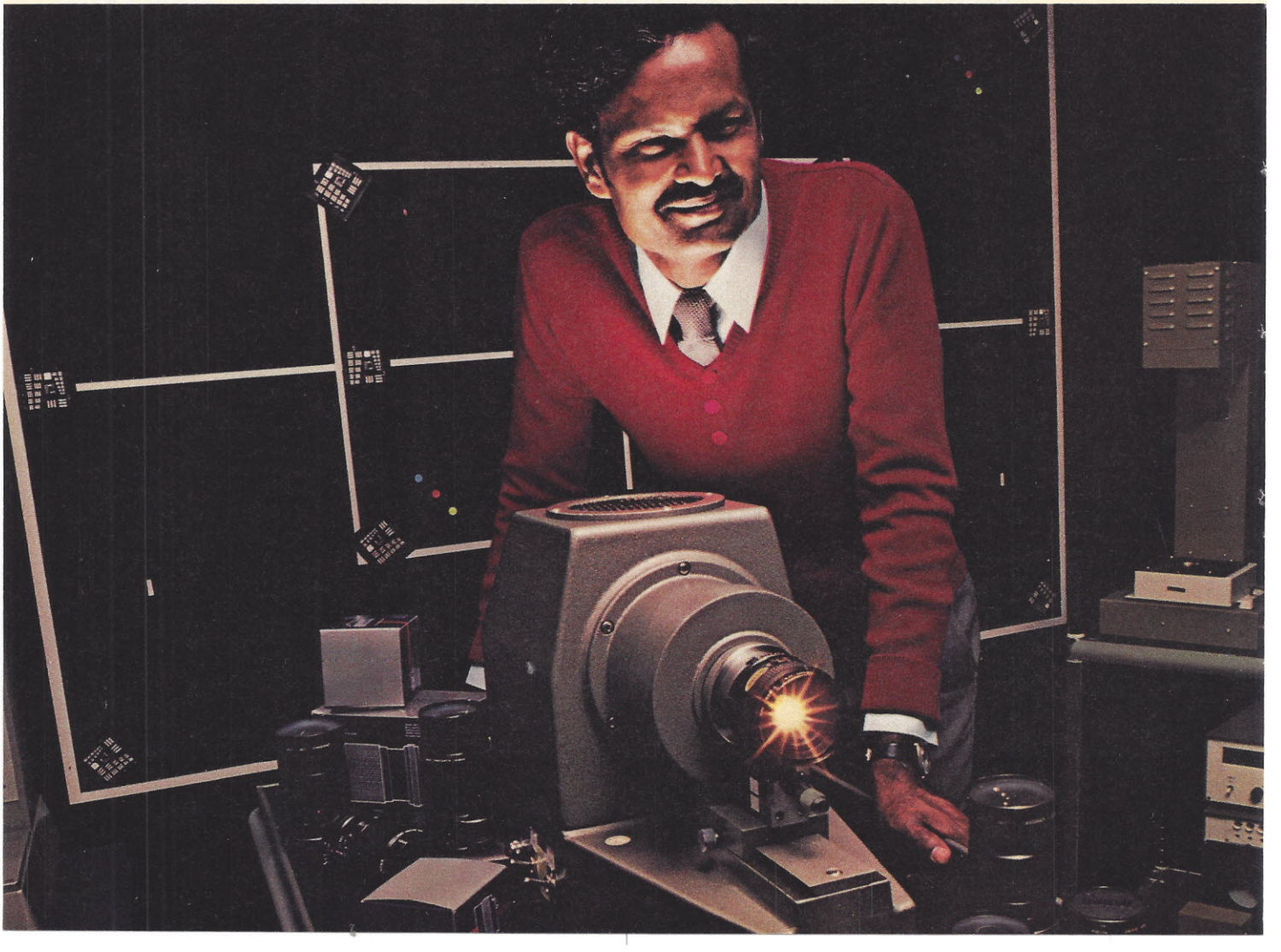
CP-202A

Reddy Chirra improves his vision with an Apple.

Reddy is an optical engineer who's used to working for big companies and using big mainframes.

But when he started his own consulting business, he soon learned how costly mainframe time can be. So he bought himself a 48K Apple II Personal Computer.

And, like thousands of other engineers



and scientists, quickly learned the pleasures of cutting down on shared time and having his own tamper-proof data base.

His Apple can handle formulas with up to 80 variables and test parameters on 250 different optical glasses.

He can even use BASIC, FORTRAN, Pascal and Assembly languages.

And Apple's HI-RES graphics come in handy for design.

Reddy looked at other microcomputers, but chose Apple for its in-depth documentation, reliability and expandability.

You can get up to 64K RAM in an Apple II. Up to 128K RAM in our new Apple III. And there's a whole family of compatible peripherals, including an IEEE-488 bus for laboratory instrument control.

Visit your authorized Apple dealer to find out how far an Apple can go with scientific/technical applications.

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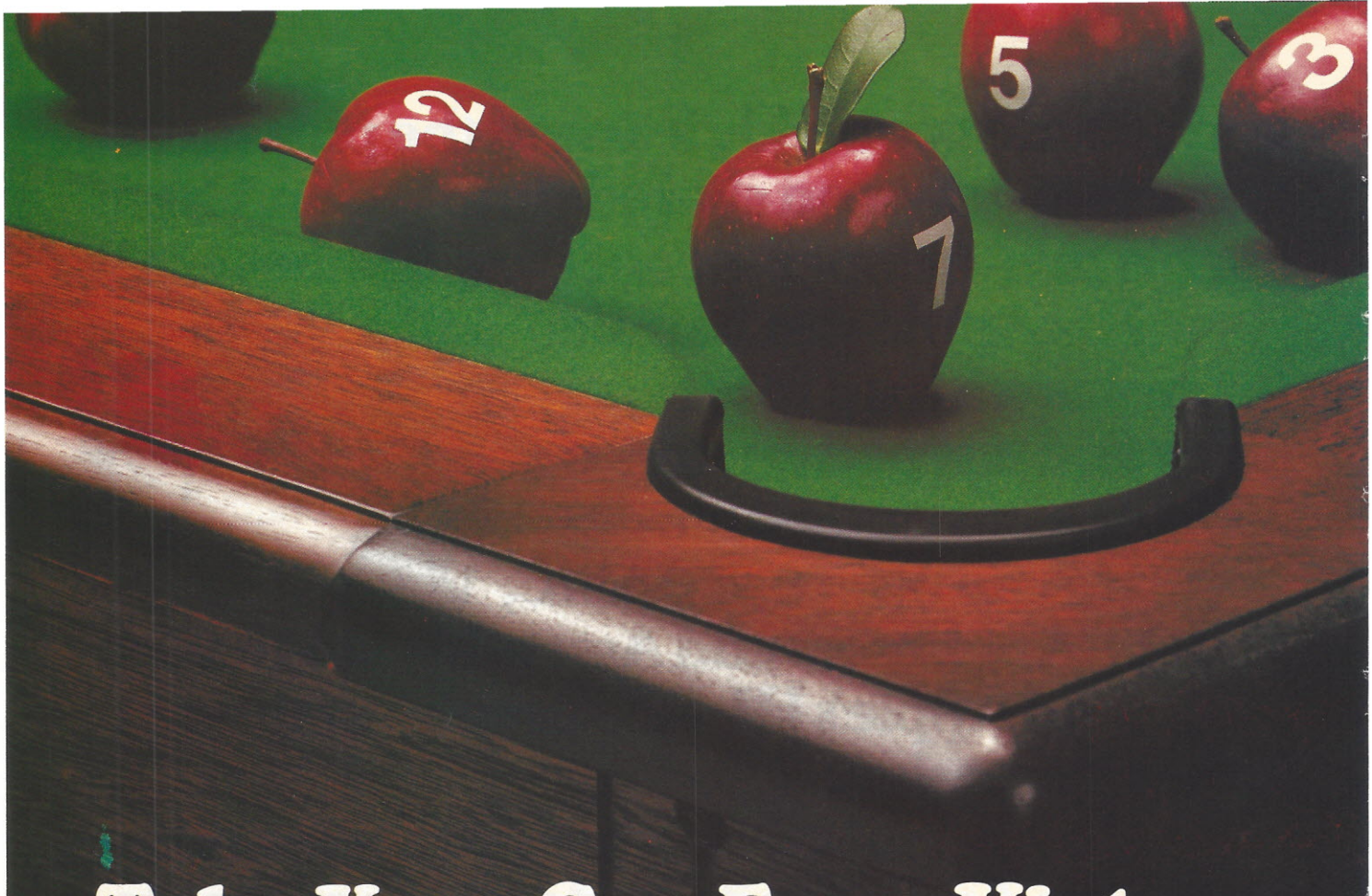


Take Your Cue From Vista . . .

When it comes to Apples, take your cue from Vista's A800 Eight-Inch Floppy Disk Controller. The A800 offers a cost-efficient approach to software compatible disk memory expansion for your Apple II® computer. The A800 Controller enables Apple II users to access up to five megabytes of online storage through conventional disk operating (DOS) commands.

The Control and DMA Logic provides high speed (1 microsecond per byte) transfer of data from the disk drive directly to the Apple II memory without processor intervention. Plus, the Phase-Locked Loop Data Separator provides the ultimate in data reliability.

AND THERE'S MORE.

The controller is compatible with the most popular disk operating systems for the Apple II computer. It also interfaces to all Shugart/ANSI Standard Eight-Inch Floppy Disk Drives. The A800 provides complete IBM format compatibility in both single and double-density modes.

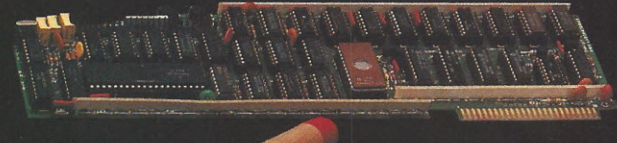
It's a Sure Shot.

THE HOT SHOT AT A COOL PRICE.

The A800 is reasonably priced at $595. A price you can't beat when you compare its quality and performance.

CALL YOUR SHOTS.

Vista offers you a complete line of peripheral equipment to maximize the capabilities of your Apple system including: High capacity Mini-floppy Disk Drives, the Vista Music Machine 9 and the Vista Model 150 Type Ahead Buffer. In addition, Vista offers a line of advanced components fully compatible with the TRS-80* and S-100 based computers.



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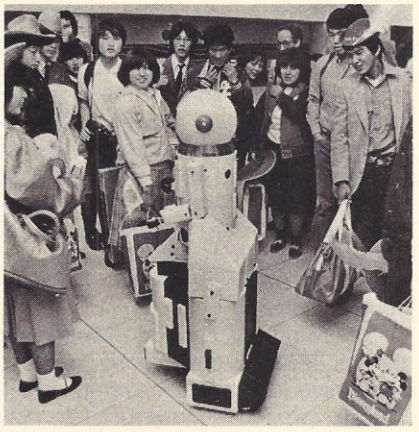
UPDATE

Huggie goes to Europe



One of the most talked-about visitors at the recent Hanover Fair in Germany was Huggie the robot. Pictured here at the LA International Airport awaiting his flight via Pan Am Airlines en route to Frankfurt, Huggie attracted considerable attention. Designed by Ray Raymond of Advanced Robotics, Newport Beach, CA, Huggie is a promotional robot designed to demonstrate the company's experiments with industrial and hobbyist robots.

Mass communications strides made by firm

The GTE Telenet public data communications network has been expanded so substantially that it is now within local dialing distance of virtually every major metropolitan area in the United States, according to Roger P. Vallo, company president.

Vallo said the network, which provides the means to move a customer's information in a reliable, economic manner, has more than doubled in the past year in capacity, geographic coverage and services provided.

The GTE Telenet network now has 207 central offices across the country, compared with 90 in 1979. These central offices contain the equipment that makes possible the "packet switching" of data.

Packet switching greatly reduces costs of transmitting data. A long-distance telephone connection made by direct distance dialing would cost $25 an hour, a WATS line would cost $20, but on a packet network, the cost drops to $4.40 per hour.

School makes computer literacy mandatory for graduation

Whether computer literacy should, or should not, be a required high school subject is a frequent topic of debate in educational circles. Advocates claim that computer knowledge is now necessary for all citizens, while detractors argue that such courses crowd traditional basic subjects out of the curriculum. At least one school in Fort Worth, TX, appears to be jumping on the pro-computer bandwagon.

Computer literacy is now a required subject at Nolan Catholic High School. Starting in fall, 1982, it will be mandatory for graduation. Twenty-one TRS-80 systems are being used in both classroom and school administration applications.

The school, under the direction of Brother Tony Pistone, SM, the school principal, has set up a computer center equipped with 15 microcomputers. Two more are stationed in math classes.

Brother Pistone indicated that the teachers, students and parents were

enthusiastic and supportive of the program. He expressed the importance of this new step by saying, "The idea I would like to suggest is that reading, writing and arithmetic are the three R's of the past, and they are still the basic competencies. But computer literacy is perhaps the fourth R. We really look forward to preparing our students both for entering college and for entering life in terms of this almost basic skill."

Language introduced for innovative educational techniques

TI LOGO, a computer language that helps students in primary through high school develop problem-solving skills has been introduced by Texas Instruments, Inc., Dallas, TX.

Designed for use on the TI-99/4 personal computer, the language is the result of cooperation between TI and the Massachusetts Institute of Technology. It has been extensively tested at the Lamplighter School in Dallas, TX and in New York City public schools. More than 1,000 students ranging from nursery school through ninth grade have used the language, and it has been given a very favorable reception by both students and teachers. In the words of one teacher, "The language creates an environment in which a child can progress at his or her own pace. This encourages the child to develop a positive self-image. It's exciting to see the children interact with the computer."

TI LOGO is structured so that even young children can successfully use the computer with little formal instruction. They use the typewriter-like keyboard to draw geometric figures and designs. They can also create multi-colored shapes on the display screen—such as rockets, balls, or trucks—and cause them to move in selected directions and speeds.

Although these activities have strong appeal to very young children, they can also lead the student to explore activities of an increasingly complex nature. In order to accomplish a task, the student must teach the computer what to do. For instance, if the student wishes to stage a rocket "blast-off" on the display, he or she may need to teach the computer such things as the shape, color, direction, and speed of the rocket.

Australian broadcasting corporation tests French teletext system

Australia has joined the growing list of countries experimenting with Antiope, the French broadcast teletext system.

The Australian Broadcasting Commission has announced that it is starting field trials of Antiope. The decision to turn to Antiope followed unsatisfactory trials of the British teletext system.

ABC officials said the British system, which was originally designed for use in UHF stations, has not tested well on the low-numbered VHF channels used by ABC. Data was distorted in its passage from the transmitter to the TV set, according to ABC, so that errors or omissions in the pages of information occurred.

A more rugged system, meaning one that is less susceptible to error, is imperative in a teletext system that is likely to be used to convey vital financial data, such as stock market quotations where an error in a single digit could have serious consequences for the viewer.

Unlike the defined format of the British system which is synchronized to the TV line structure, Antiope has an asynchronous transmission. In addition, the speed of transmission is easily adjusted to minimize the possibility of error, and Antiope's patented transmission system, DIDON, has its own correction capability.

Integrated word processing achieved in curriculum package

The first integrated word processing curriculum to train operators in both business concepts and word processing techniques has been introduced by Lanier Business Products, Atlanta, GA.

"With business and industry projections showing that more than 5 million word processing operators are required by 1985, the Automated Business Curriculum gives both educators and trainers the tools to instruct and prepare new operators," said Charlie Hall, the firm's vice president, typing systems division, in making the new product announcement.

"The only way to meet this fast moving requirement is through a cooperative effort of educators and suppliers of word processing equipment and that is exactly the method we used to develop this integrated training package," Hall stated.

The program contains student reference guides, a student learning center with audio cassettes, and an instructor's guide in one package. The instructional material also contains self-check quizzes and actual office concepts and operations.

The program was jointly developed by Lanier word processing specialists and a National Educational Advisory Council, comprised of seven leading word processing professors.

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Jurisprudent Computerist

By Elliott MacLennan
Attorney at Law

The Detection and Avoidance of Spotted Elephants

Two private letter rulings issued by the IRS (though not earthshaking) are worthy of mention. First, a private letter ruling is the position taken by the IRS with respect to a taxpayer. Technically, a private letter ruling is good only between the taxpayer and the IRS and cannot be used by any other taxpayer against the IRS. In reality, I would have little difficulty with my conscience in wallpapering the IRS' office with private letter ruling if I felt they were helpful to my client.

The first ruling was a request by a corporate taxpayer whose business plan was to create a franchise and sell franchises to owners of commercial realty providing the owner with national recognition and a uniform system of management. The national recognition, it was felt, would enable building owners to obtain tenants from the national referral system established by the franchisor. Facilitating the referral operation was a microcomputer, et. al. owned by the corporate taxpayer where each microcomputer was located at the respective realtor's offices by lease arrangement. The IRS held that the newly purchased and leased computers used in the franchising operation qualified for the investment tax credit so dear to us all.

The second private letter ruling is somewhat unique. In brief summary, several parties purchased a building and leased computer equipment. The financing was accomplished from tax exempt Industrial Development Bonds. The nature of the business enterprise was unspecified. The holding of this ruling was that the party leasing the computer equipment also qualified for an investment tax credit.

What interests me about this ruling is that the IRS is extremely reluctant to permit certain deductions and credits, i.e. investment credits upon a project financed by tax exempt funds. Why? The taxpayer is getting a tax credit on moneys generated by non taxable dollars; therefore, the IRS picks up the tax tab.

If a true base is created, the lessor has the rights of ownership for tax purposes.

Even more importantly, the IRS classified the lease as a "true" lease. The guidelines for what is a true lease vs. a disguised conditional sales contract are set forth in Revenue Ruling 55-540 (public ruling not private). In this famous ruling by the IRS, the IRS has set forth the criteria for whether or not the legal instrument entitled Equipment Lease is really a lease or not. If a true lease is created, the lessor has the rights of ownership for tax purposes, which include depreciation and the election to retain or "pass through" the investment tax credit.

If the lease fails the tests of Revenue Ruling 55-540 and is classified as a disguised conditional sales contract, the lessee is the owner. This means that the lessee is entitled to take investment tax credit and depreciation on the equipment. Usually the "true" problem arises upon audit two or three years down the line with the result that all the depreciation and investment tax credits are disallowed and, to add insult to injury, the IRS assesses interest and penalties as quite properly they should.

Every business person should have an intimate knowledge of Revenue Ruling 55-540 *prior* to commencing leasing operations. As one judge on the Arizona Court of Appeals commented, it does not matter what you label your agreement: you can even call it a "spotted elephant," the instrument is what its words define it to be; not what it is labeled.

New publications

A legal treatise entitled Forms and Agreements on Intellectual Property and International Licensing is a powerful tool for contemplating international computer operations. One distinguishable feature of this three pound book is that the author discusses protection of computer programs and ROM protection in Latin.

Those aspects of a computer program including flow charts and manuals are called Ocullegendic, meaning eye-readable. Object codes and the like are described as Oculopacic, meaning non eye-readable (literally eye-obscure). I must bring this column to a rapid close. I have decided to dash off to my opthalmologist to have my eyes checked. □

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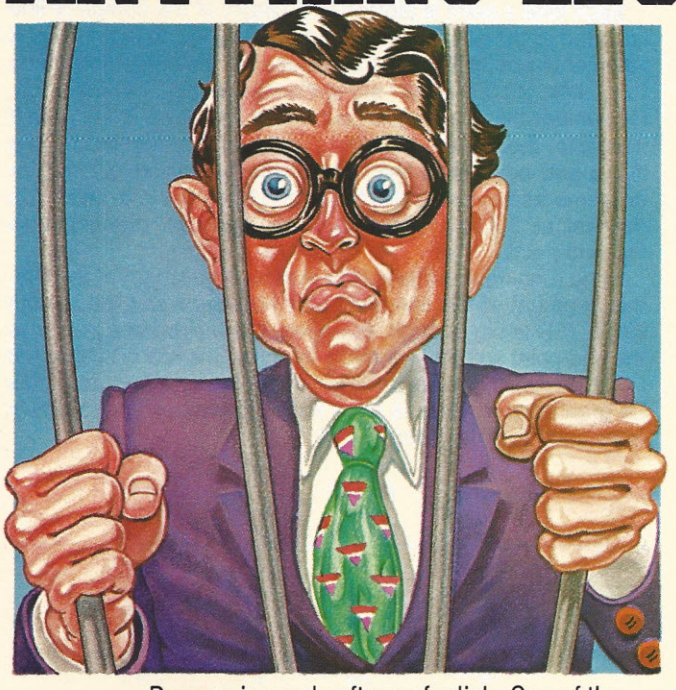

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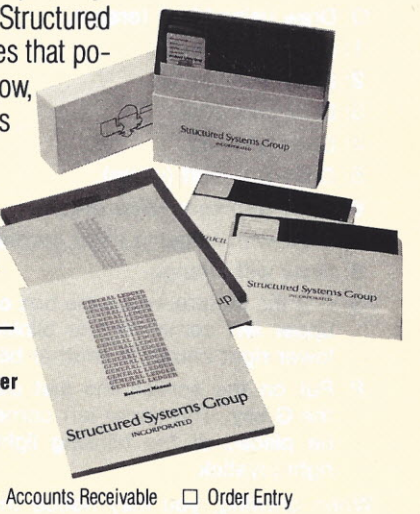

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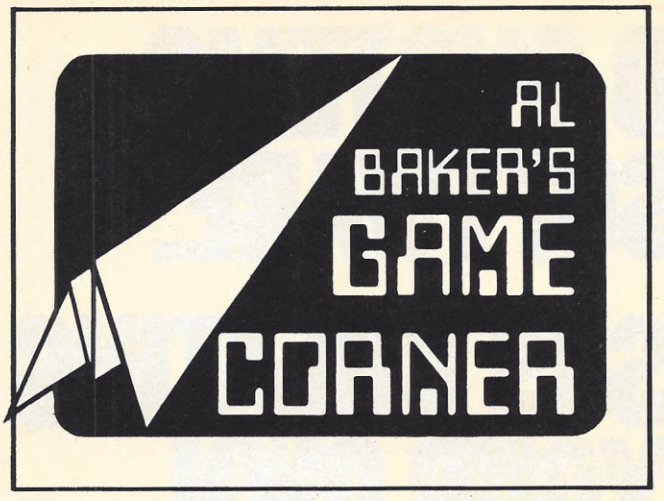


The Electronic Easel

Extended Basic on the TRS-80 color computer provides the most powerful set of built-in art and sound commands of any popular home computer. But you can't use these commands if your computer lacks Extended Basic, or you don't own a color computer. This month I have taken four of the drawing commands available in Extended Basic and put them together into an enjoyable art package. The commands are: LINE, CIRCLE, GET and PUT.

It is possible for this program to fail in a 4K computer. If it does, remove all REMark statements. Run the program and play with the two joysticks. You should see two white dots moving around on a black screen. To draw, use the keyboard as follows.

L: Draw a line between the two dots.

C: Draw a circle whose center is at the right joystick dot and whose edge is on the left joystick dot.

O: Draw using black (erase).

1: Draw with green.

2: Draw with yellow.

3: Draw with blue.

4: Draw with red.

5: Draw with buff (white).

6: Draw with cyan (blue green).

7: Draw with magenta (near purple).

8: Draw with orange.

G: Get the picture inside the box on the screen whose upper left corner is one blinking light and whose lower right corner is another blinking light.

P: Put on the screen the last picture obtained with the G key. The upper left corner of the picture will be placed at the blinking light controlled by the right joystick.

When drawing, you may notice that moving the blinking dots across the picture may change the colors of objects already drawn. There is no way to easily correct this problem. It is part of the design of the low resolution graphics hardware built into the color computer. If you convert the program to an Apple or Atari, this problem will disappear.

The line routine has several fine features. First, it doesn't use either division or multiplication. This provides a nice routine to convert it into machine language. It also draws a balanced line. Most line drawing methods use division, which tends to create a line with less slope at its beginning and more slope at the other end.

But the routine also has one bad feature: it is not obvious and nearly impossible to understand. This is explained by the fact that it was developed by three computer scientists working with I.B.M.: Louis Cesa, Eduardo Kellerman, and Robert Hitchcock Sr. Often in computer science, the better, faster, and more compact ways of doing things are hard to understand and sometimes resemble magic.

The secret is the running average R. Line 1000 starts this running average at 0 and determines the distance along the X-axis (DX) and Y-axis (DY) between the two points. The current point on the line to be drawn is (X,Y). Line 1040 determines if this point is on the screen and, if it is, line 1045 plots it. Since the color computer handles black as a special case, line 1045 checks the color. If it is black, the point on the screen is turned off. Otherwise, the correct color is plotted.

The line routine next divides into two cases. Lines 1090 to 1110 draw the line if it is longer along the X-axis, while lines 1140 to 1160 draw the line when it is more vertical. Since both cases are mirror images, we will study the first only. Line 1090 checks to see if the final point has been plotted. If so, the routine is finished.

Each time a point is plotted, the height of the complete line is added to the running average (R = R + DY) and the current X value of the point is moved one closer to the end-point. To do this, line 1100 uses comparisons within an equation. Remember that if a comparison is true, the value is −1, and if it is false, the value is 0. In this case, X is incremented by one if the end point is to the right of the beginning (X2>X1) or decremented by one if it is to be left (X2<X1). Next, line 1105 determines if it is time to move the value of Y one closer to the end-point.

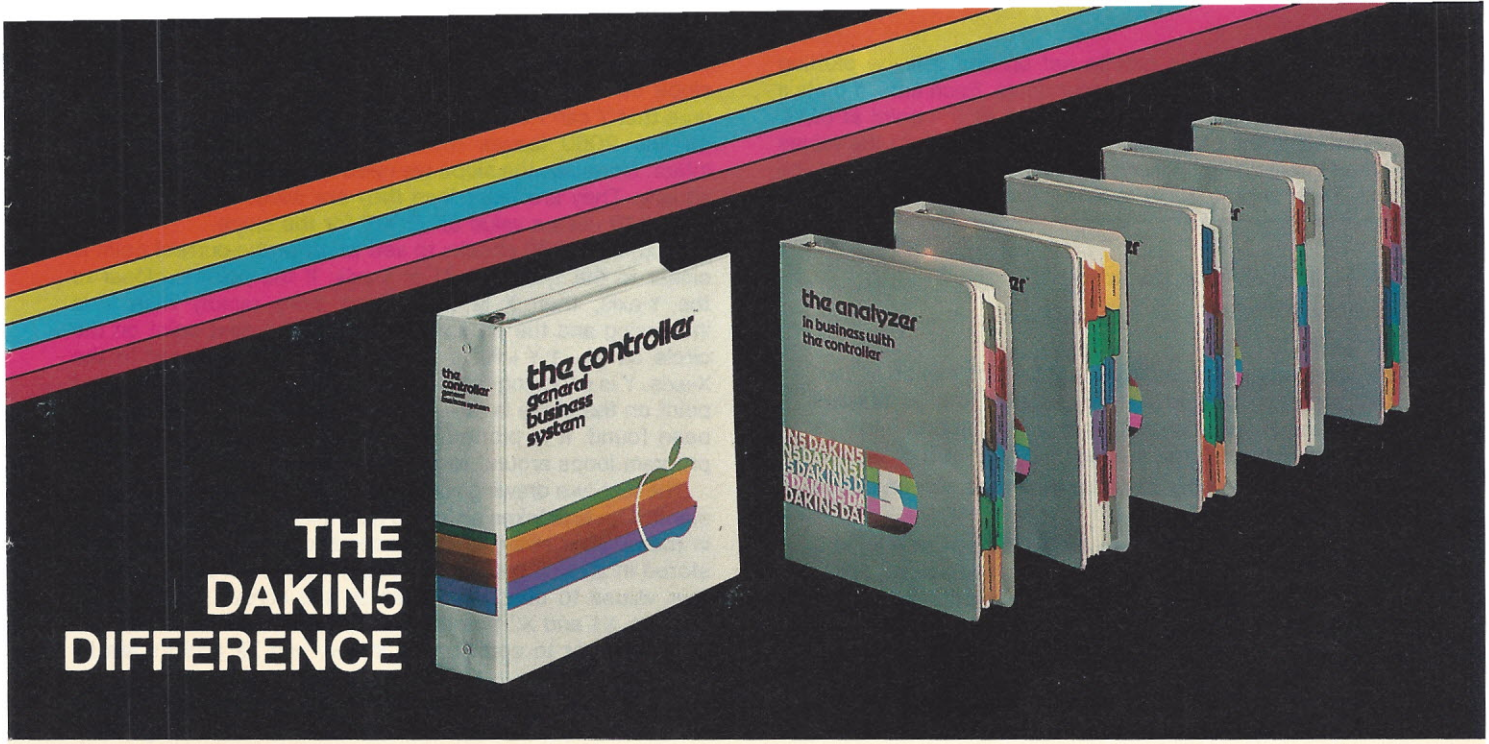
If the running average is less than half the length of the line, this segment of the line must stay horizontal and the routine loops. If R is big enough, however, Y is moved one closer to the end-point and the horizontal length of the line is subtracted from the running average. Simple? If not, try some examples on graph paper. Here is what happens when a line is drawn from point (0,0) to point (14,6).

DX = 14	DY = 6		
X	R (+6)	Y	R (−14)
0	0	0	
1	6	0	
2	12	1	−2
3	4	1	
4	10	2	−4
5	2	2	
6	8	3	−6
7	0	3	
8	6	3	
9	12	4	−2
10	4	4	
11	10	5	−4
12	2	5	
13	8	6	−6
14	0	6	

The next routine draws a circle whose center is at (X1, Y1) and which contains another point (X2, Y2) on its circumference. The circle is drawn without the need of a square root function. Instead of computing the Y value of the next point on the circle using the equation Y = SQB(D*D − X*X), the routine finds the next point by following the curve itself.

The next point on a circle is on the line perpendicular to the radius of the circle at the current point. To work, the program assumes the center of the circle is at location (0,0). If this is true, the location of the point on its circumference is (X2 − X1,Y2 − Y1) and, since circles are perfectly symmetrical, there is a point on the circle with the following positive coordinates: (ABS(X2 − X1),(ABS(Y2 − Y1)). Line 2000 assigns these coordinates to X and Y, the first point on the circle to be drawn, and line 2010 stops the routine if this is also the center of the circle. A circle with a radius length of 0 is no circle.

Circles are perfectly symmetrical. Therefore, by reversing the values of X and Y, a point can be plotted in each of its four major quarters: upper right (X>0, Y>0), upper left (X<0, Y>0), lower left (X<0, Y<0) and lower right (X>0, Y<0). The routine



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on line 2210 uses this fact to set up and call the plotting program starting at line 2250, four times. Each time, it plots a different one of the four mirror images of the point at (X,Y). The first thing the plotting program does is correct the values of X and Y by adding the real coordinates for the center of the circle. Then, on line 2255, it determines if the point is on the screen and, on line 2260, places the correct value (black or color) at the point.

- Multiple screens (for animation)
- Partial circles
- Drawing boxes
- Generation of complex shapes which can be scaled, rotated, or placed at relative angles to other shapes. These shapes can also be used as "subroutines" or "sub-shapes" that are part of other shapes.
- The inside of any closed area on the screen can be filled with a color.
- When PUTting a picture on the screen, use logic to place it there: OR the picture onto the screen, AND it onto the screen, or NOT the picture onto the screen.

Other graphic commands

The circle drawing routine is divided into two parts. The first part draws from the original point on the circle counter-clockwise until it reaches the Y-axis, or X≤0. The second part starts at the original point and draws clockwise until it reaches the X-axis, or Y≤0. Since the two parts are nearly identical, we need only review the first.

The slope of a line that starts at (0,0) and ends at point (X,Y) is Y/X. This is the slope of the radius of the circle. The slope of the line perpendicular to this line, the tangent, has a slope of X/Y. To use this formula, the program must make sure that Y can't equal 0. If it does, setting it slightly above 0 on line 2060 leaves the program's accuracy reasonably intact. Normally, the slope we need is X/Y, but our dots aren't square. They are taller than they are wide. To correct this, line 2070 uses a value of .5*X/Y for the slope.

Next, line 2070 checks to see whether the current point is closer to the Y-axis (R<1) or X-axis. If the point is closer to the Y-axis, then X is decreasing more rapidly than Y is increasing and the program computes the next point on the circle as (X – 1,Y + R). If the current point is closer to the X-axis, Y is changing faster than X and the position of the next point on the circle is (X – 1/R,Y + 1). Once the new point has been found, it is plotted, along with all its images, and the program loops around to finish the circle.

The last two drawing routines are short and easy to understand. The first takes an image from the TV screen and puts it in the number array A. The second routine takes the image stored in array A and places it back on the screen. Both use four values to describe where on the screen the image is located: X1 and X2 point to the upper left corner of the box containing, or to contain, the image, and XX and YY are its width and height.

Lines 3000 and 3040 form the outside loop for the first routine. Here I moves across each column of the image while II moves across each corresponding column of A. The inner loop is formed by lines 3010 and 3030. At each column in the image, pointed to by I, J travels vertically down the rows, while JJ moves down each corresponding row in A. As a result, at line 3020, every point of the image is examined.

If the point is still on the TV, its value is placed in array A. If the point contains a character and not a colored dot then POINT(I,J) is equal to –1. By taking the absolute value of POINT, all text on the screen is changed to color number 1, or green. Since this is the same color as a blank, the image

placed in A is the same as the image on the screen with all text blanked out.

The PUT routine on lines 4000 to 4070 is nearly identical to the GET routine we just studied. The only differences are on lines 4020, 4030, and 4040. Instead of getting the image, it must be put back on the screen. To do this, line 4020 gets the color of the image and line 4030 determines if the point to be colored is on the TV screen. If it is, line 4040 sets the correct point on the screen to its new color, or black, depending on the value of CC.

Remainder of loop formed

The program variables are set up on lines 60 to 80. Here the GET and PUT array A is dimensioned, the initial color C is defined, and the screen cleared to black. The remainder of the program, from lines 120 to 410, forms the art loop. First, in lines 120 and 130, the two values of each joystick are used to define the coordinates of the blinking lights: (X1,Y1) and (X2,Y2). Then, in lines 170 to 240, they're blinked.

This is done by first looking at the color already on the screen (K = POINT(X1,Y1)) and coloring the spot if it is black, or blackening it if the spot is colored. Then, after getting the artist's request on line 190, the original color is put back. If it was originally black, it is blackened, and if it was colored, the original color is restored.

The remainder of the program follows the artist's commands. If he made no request, the program loops back to line 120 and looks at the joysticks again. If a request was made, lines 290 through 330 obey it; commands P, L, and C are handled easily, and setting the new color on line 330 is straightforward. The only difficulty is obeying the G, or GET request. This is figured out on lines 380 to 410.

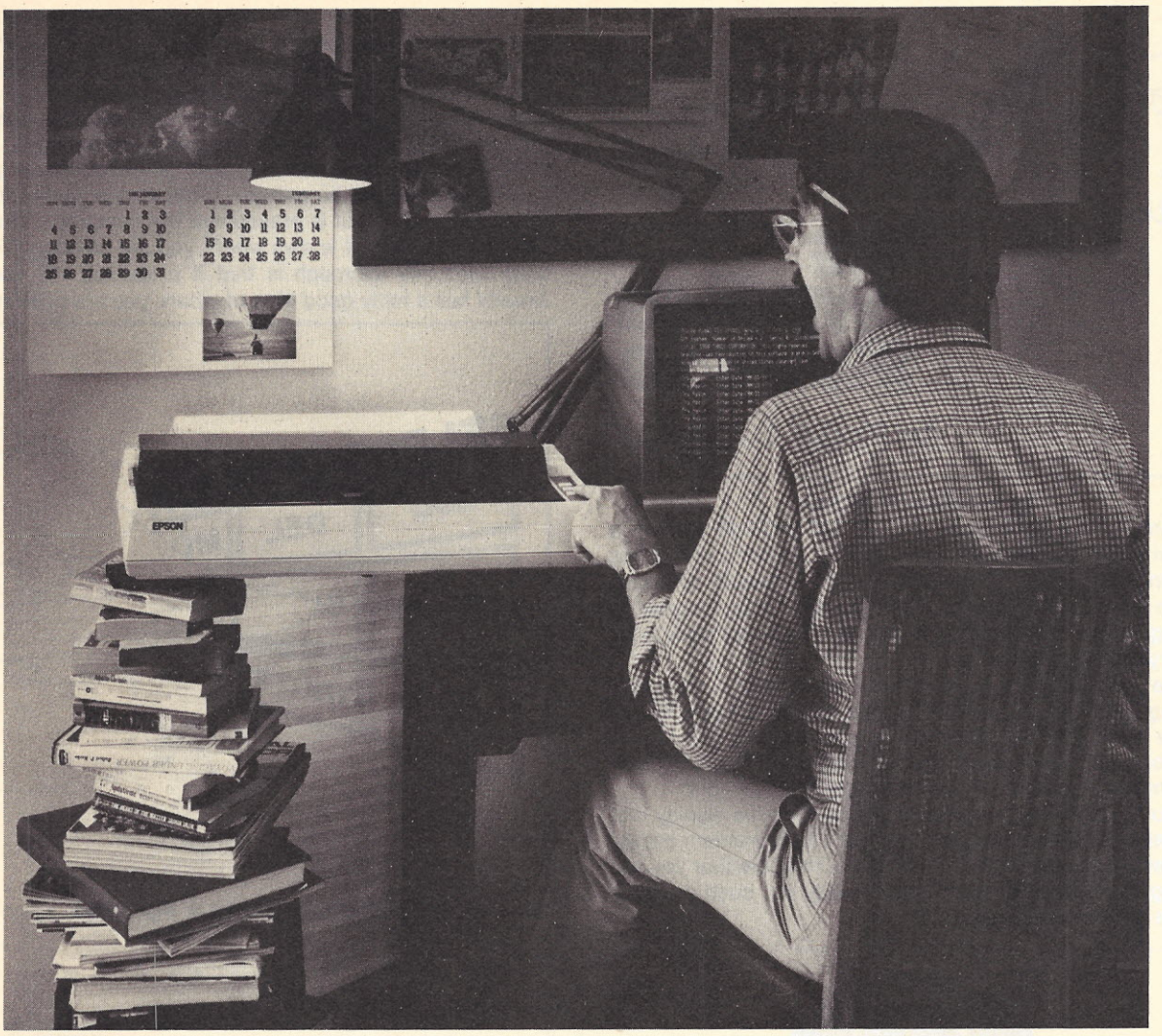
The GET command insists that the upper left corner of the image is at (X1,Y1), but the artist can place either blinking light there. To correct this, line 380 computes the width, XX, and height, YY, of the box containing the image using the absolute distance between X1 and X2, and Y1 and Y2. As an example, if X1 = 3 and X2 = 10, ABS(X2 – X1) + 1 = 8, which is the correct number. Likewise, if X1 = 10, and X2 = 32, ABS(X2 – X1) + 1 = 8 and the result is the same. The next two lines, 386 and 387, check to see which light is, in fact, at the upper left corner. If it is (X2,Y2), then the values of X1 and Y1 are changed.

Finally, lines 390 and 400 make sure that a box bigger than array A isn't used, and line 410 calls the GET routine on line 3000. Try using the program to create real art on the TV screen. You may be surprised at how easy and fun it is. In particular, I found the GET and PUT routines to be extremely powerful tools for filling areas with patterns, or even solid color. Experiment with the program. Is there anything you might want to add? How about saving pictures on tape? If you come up with any additions, or if you convert it to another computer, send in a listing and we can share it with other readers. □

Program listing

```
10 REM      THE ELECTRONIC EASEL
20 REM
30 REM
40 REM SET UP STARTING CONDITIONS
50 REM
60 DIM A(10,10)
70 CLS 0
80 C=5
90 REM
100 REM THE DRAWING LOOP
110 REM
120 X1=JOYSTK(0):Y1=INT(JOYSTK(1)/2)
130 X2=JOYSTK(2):Y2=INT(JOYSTK(3)/2)
140 REM
150 REM    BLINK THE TWO DRAWING LIGHTS
160 REM
170 K=POINT(X1,Y1):IF K>0 THEN RESET(X1,Y1) ELSE SET(X1,Y1,C)
180 L=POINT(X2,Y2):IF L>0 THEN RESET(X2,Y2) ELSE SET(X2,Y2,C)
190 A$=INKEY$
200 REM
210 REM UNBLINK THE DRAWING LIGHTS
220 REM
```

```
230 IF K=0 THEN RESET(X1,Y1) ELSE SET(X1,Y1,K)
240 IF L=0 THEN RESET(X2,Y2) ELSE SET(X2,Y2,L)
250 IF A$="" THEN 120
260 REM
270 REM  ACT ON ARTIST'S REQUEST
280 REM
290 IF A$="G" THEN 380
300 IF A$="P" THEN GOSUB 4000
310 IF A$="L" THEN GOSUB 1000
320 IF A$="C" THEN GOSUB 2000
330 IF (A$>="0") AND (A$<"9") THEN C=VAL(A$)
340 GOTO 120
350 REM
360 REM PREPARE FOR PICKING UP A PICTURE
370 REM
380 XX=ABS(X2-X1)+1:YY=ABS(Y2-Y1)+1
386 IF X2<X1 THEN X1=X2
387 IF Y2<Y1 THEN Y1=Y2
390 IF XX>10 THEN X=10
400 IF YY>10 THEN Y=10
410 GOSUB 3000:GOTO 120
950 REM
960 REM
970 REM
980 REM FAST, ACCURATE LINE ALGORITHM
990 REM
1000 R=0:DX=ABS(X2-X1):DY=ABS(Y2-Y1)
1005 X=X1:Y=Y1
1010 REM
1020 REM PLOT THE CURRENT POINT
1030 REM
1040 IF (X<0) OR (X>63) OR (Y<0) OR (Y>31) THEN 1050
1045 IF C=0 THEN RESET(X,Y) ELSE SET(X,Y,C)
1050 IF DX<DY THEN 1140
1060 REM
1070 REM HANDLE LINES NEARER TO THE HORIZONTAL
1080 REM
1090 IF X=X2 THEN RETURN
1100 X=X+(X2<X1)-(X2>X1)
1105 R=R+DY:IF R+R<DX THEN 1040
1110 Y=Y+(Y2<Y1)-(Y2>Y1):R=R-DX:GOTO 1040
1115 REM
1120 REM HANDLE LINES NEARER TO THE VERTICAL
1130 REM
1140 IF Y=Y2 THEN RETURN
1150 Y=Y+(Y2<Y1)-(Y2>Y1)
1155 R=R+DX:IF R+R<DY THEN 1040
1160 X=X+(X2<X1)-(X2>X1):R=R-DY:GOTO 1040
1950 REM
1960 REM
1970 REM
1980 REM DRAW CIRCLES WITHOUT NEEDING SQUARE-ROOTS.
1990 REM
2000 X=ABS(X2-X1):Y=ABS(Y2-Y1)
2010 IF X+Y=0 THEN RETURN
2020 GOSUB 2210
2030 REM
2040 DRAW COUNTER CLOCKWISE
2050 REM
2060 IF Y=0 THEN Y=.01
2070 R=.5*X/Y:IF R<1 THEN X=X-1:Y=Y+R:GOTO 2090
2080 Y=Y+1:X=X-1/R
2090 GOSUB 2210
2095 IF X<=0 THEN 2130 ELSE 2070
2100 REM
2110 REM DRAW CLOCKWISE
2120 REM
2130 Y=ABS(Y2-Y1):X=ABS(X2-X1)
2135 IF X=0 THEN X=X+.01
2140 R=2*Y/X:IF R<1 THEN Y=Y-1:X=X+R:GOTO 2160
2150 X=X+1:Y=Y-1/R
2160 GOSUB 2210
2165 IF Y<=0 THEN RETURN ELSE 2140
2170 REM
2180 REM PREPARE TO PLOT A POINT IN ALL
2190 REM FOUR QUARTERS OF THE CIRCLE
2200 REM
2210 GOSUB 2250:X=-X:GOSUB 2250:Y=-Y:GOSUB 2250:X=-X:
     GOSUB 2250:Y=-Y:RETURN
2220 REM
2230 REM PLOT THE POINT
2240 REM
2250 X=X+X1:Y=Y+Y1
2255 IF (X<0) OR (X>63) OR (Y<0) OR (Y>31) THEN 2270
2260 IF C=0 THEN RESET(X,Y) ELSE SET(X,Y,C)
2270 X=X-X1:Y=Y-Y1
2275 RETURN
2950 REM
2960 REM
2970 REM
2980 REM PLACE AN IMAGE IN ARRAY A
2990 REM
3000 II=0:FOR I=X1 TO X1+XX-1
3010 JJ=0:FOR J=Y1 TO Y1+YY-1
3020 IF (I<=63) AND (J<=31) THEN A(II,JJ)=ABS(POINT(I,J))
3030 JJ=JJ+1:NEXTJ
3040 II=II+1:NEXTI
3050 RETURN
3950 REM
3960 REM
3970 REM
3980 REM PLACE IMAGE ON SCREEN FROM ARRAY A
3990 REM
4000 II=0:FOR I=X1 TO X1+XX-1
4010 JJ=0:FOR J=Y1 TO Y1+YY-1
4020 CC=A(II,JJ)
4030 IF (I>63) OR (J>31) THEN 4050
4040 IF CC=0 THEN RESET(I,J) ELSE SET(I,J,CC)
4050 JJ=JJ+1:NEXTJ
4060 II=II+1:NEXTI
4070 RETURN
```



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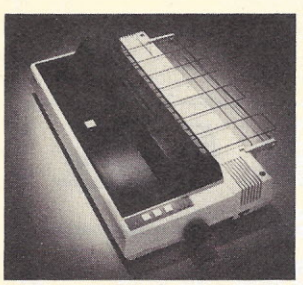

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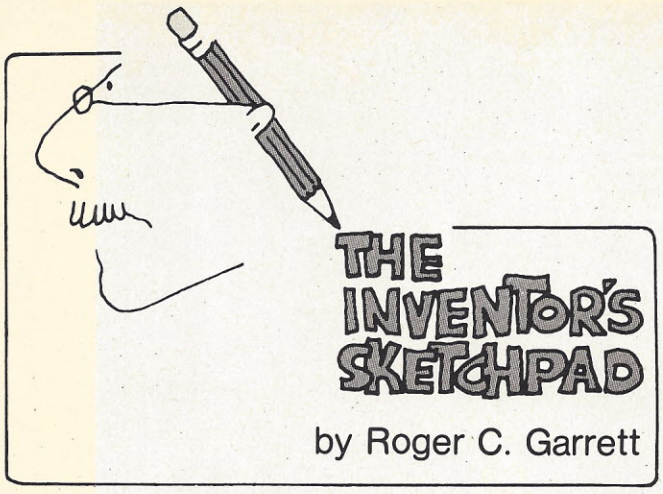


by Roger C. Garrett

An Invisible Lightpen

A lightpen is a very handy device that you can point at a spot on a CRT display with the computer knowing where you are pointing (figure 1). It can be used, for example, to select an item from a displayed list of options. Or, it can be used to draw figures on the screen by having the computer draw a dot at every indicated position.

While your first impression is that the pen itself is somehow emitting light that is detected by the display screen, this is not the case. The pen consists simply of a lens and photo-detector mounted in a pen-shaped case. The pen only tells the computer whether or not it is detecting any light.

If you are pointing the pen at some spot on the display that is currently on, the computer can know it. A problem arises, however, when you want the computer to know that you are pointing at some spot that is not already on, such as when you are drawing new spots.

There are two basic approaches to solving this problem. In one approach, we presume that the computer already knows approximately where the pen is pointing. The computer then displays a series of dots in that general area (often in a spiral or star-shaped pattern). As it momentarily displays each spot, it determines whether or not the pen is detecting it.

If the pen registers 'no', the spot is erased and it goes on to the next spot in the pattern. If the pen indicates that it is detecting it, the spot is erased and the computer goes on to its next task when it knows where you are pointing. The problem with this approach is that it presumes the computer already has a fairly good idea of where you are pointing, so it doesn't have to keep spiraling out looking for your pen. It's also possible that you aren't even pointing at the screen, in which case you don't want the computer flashing spirals or stars all over the place.

The other approach solves some of these problems, but raises another one. In this approach, the computer only looks for the pen position when you specifically request it, usually by pressing the pen against the display screen, which trips a switch in the pen. Since the computer does not have any idea where the pen is, it sequentially tries every single spot on the display, not in a spiral or other such fancy pattern, but dot by

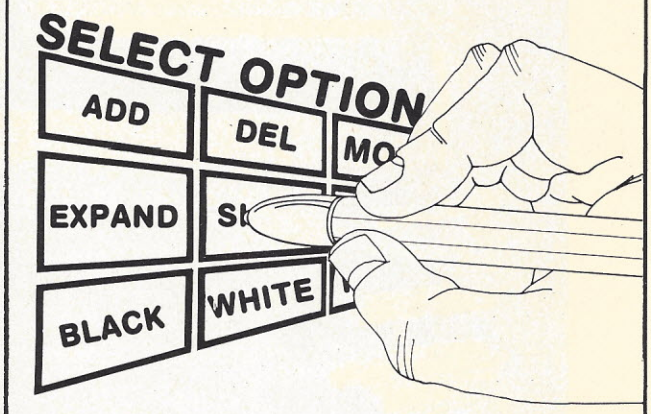


Figure 1. Using a lightpen

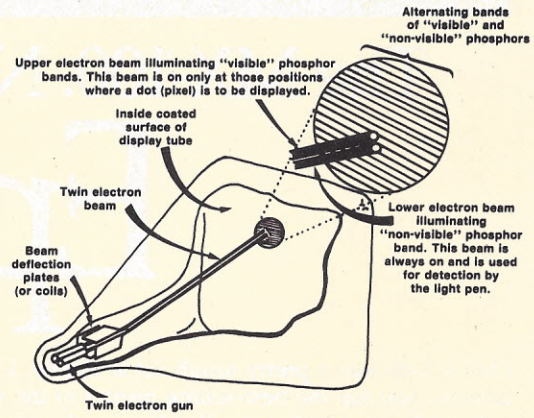
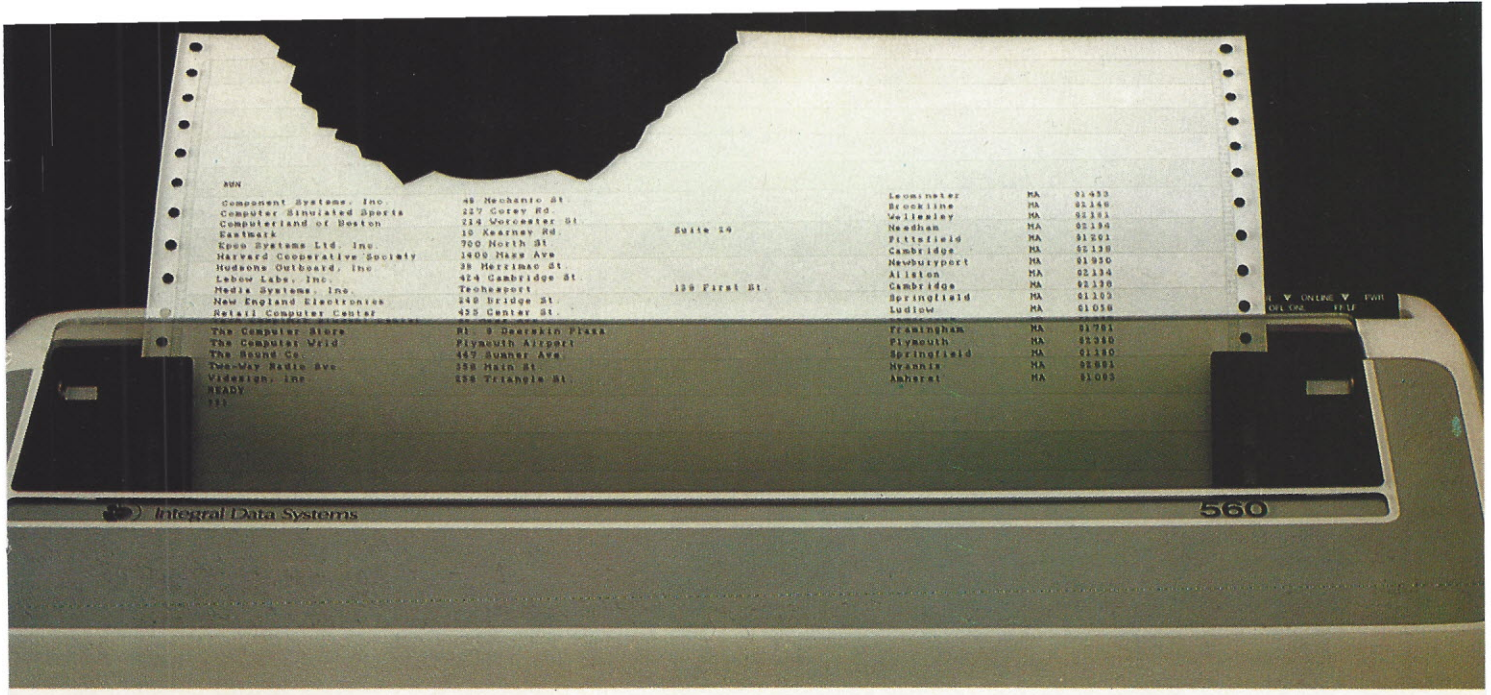


Figure 2. Modification of the display tube



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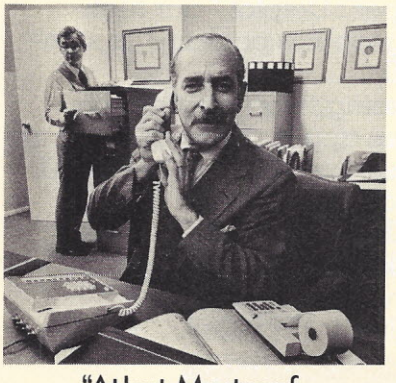

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dot from top to bottom, left to right. It does it quite fast, but the result is a very annoying bright flash of the screen.

Now, if you are trying to draw something or select several menu items in a row, those flashes can be quite distracting. You will probably opt to go back to standard keyboard data entry rather than the more fancy, so-called 'state-of-the-art' lightpen. Although it is possible to combine the two approaches (using the pattern search when the pen position is approximately known and only using the full screen search when the computer gets lost), I have another suggestion.

Suppose we modify the display tube itself (figure 2). Instead of coating the inside of the CRT with the standard phosphor (which glows whenever it is struck by the electron beam), we coat it with alternating bands of visible (standard) and non-visible phosphor. The non-visible phosphor also glows when struck by an electron beam, but it glows in the non-visible portion of the light spectrum. (I'm making a wild, and perhaps naive assumption that such a phosphor exists or could be developed.)

Scanning visible bands

We also add a second electron gun beneath the existing one. Both guns emit streams of electron beams that scan the inside surface of the CRT in raster mode (i.e. TV style; left-to-right, top-to-bottom). The upper beam scans the visible bands and is turned on only at those positions where a visible dot is to be displayed, perhaps forming part of a character or a graphic image. The lower beam scans the non-visible bands just below the visible bands. The lower beam is always on, illuminating the bands, but not visible to the user watching the display.

We modify the lightpen (figure 3), so that it is sensitive only to the portion of the light spectrum that is emitted by the non-visible bands. Whenever we place the pen tip up against the

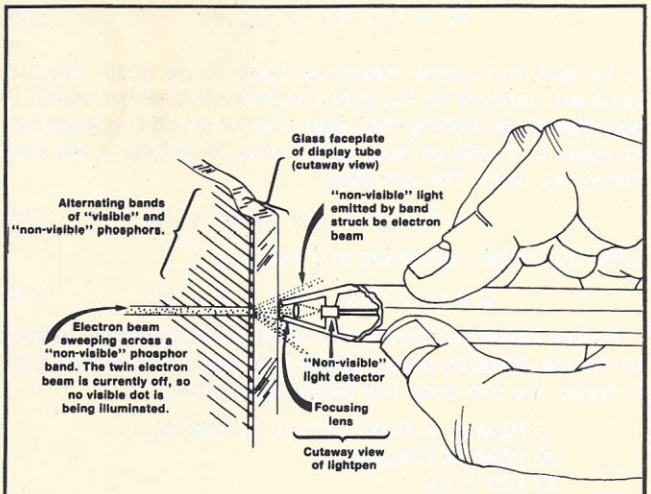
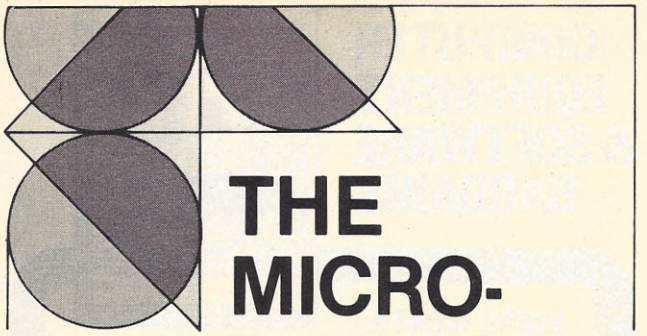


Figure 3. Modification of the lightpen

display screen, the scanning beam will eventually (within one-thirtieth of a second) get to the position we are pointing at. The pen will detect the non-visible light and the computer, since it knows (by very accurate timing and synchronization) where the beam is, and what spot we are pointing at.

Such an approach totally eliminates the need for pattern searches or screen-flashing searches. Indeed, the user need not even be aware of how the computer knows what he is pointing at. It just does. And it does it in a very friendly manner. □



THE MICRO-MATHEMATICIAN

by Dr. John C. Nash

Infinite Series: Knowing When to Stop

Sequences of numbers have fascinated mankind for thousands of years. Think only of the tarot cards or the roulette wheel. A general sequence of numbers can be written

$$t_1, t_2, t_3, \ldots, t_j, \ldots \quad (1)$$

where the quantity t_j is the j^{th} member of the sequence. A series is the sum of the members of a sequence. For the sum of the first j members we write

$$S_j = t_1 + t_2 + t_3 + \ldots + t_j. \quad (2)$$

In many cases, series are infinite in that the sequence of terms t_j may go on forever. An infinite series may nevertheless have a finite value for the sum S and be said to converge. If the sum simply gets larger and larger as more terms are added, it is said to be diverge.

In the eighteenth and nineteenth centuries, series were perhaps the main tool of the mathematician. This month, we shall look at the more general problem of computing the sum of an infinite series, which is essentially a question of stopping when a sufficiently accurate result has been computed. Obviously, the sooner we can stop, the less work our computer must do, but we do not wish to incur a significant error because we have left too many terms out of the sum. (This is called truncation error.) Furthermore, we need to be aware of the old problem of adding small numbers to large ones in finite length arithmetic.

An example of a sequence of use in many applications, in particular loan and mortgage calculations, is the geometric progression (GP), for which the j^{th} member is

$$t_j = a\, r^{j-1} \quad (3)$$

where a and r are two constants that define a particular progression. GPs are easy to sum analytically, that is, by formula rather than by computer. For a finite sum of n terms we have

$$S_n = a + ar^2 + \ldots + ar^{n-1} \quad (4)$$

$$r\,S_n = \quad ar + ar^2 \ldots + ar^{n-1} + ar^n \quad (4a)$$

where the second equation is obtained from the first by multiplying through by r. We now subtract to get

$$S_n - r\,S_n = a - ar^n \quad (5)$$

since all the middle terms cancel. This leaves a simple rearrangement to

$$S_n = a\,(1 - r^n) / (1 - r). \quad (6)$$

We now note that if ABS(r) is less than 1, we can take the limit of this expression as n goes to infinity to force r^n to zero and leave the infinite series sum

$$S = a / (1 - r). \quad (7)$$

We note that the series diverges if the magnitude of r is greater than 1 because we always add an amount at least as big as the first term, a, with each term introduced.

One of the uses of a GP is in proving the convergence or divergence of other series. After all, it is not a good idea to try the summation of a series if we know it diverges. Equally, the knowledge that a series is convergent encourages us to try harder when the approach to the limit is slow.

As an example of the utility of the GP in proving convergence, consider the problem posed in an earlier article of summing all terms.

$$t_j = 1 / (j\,(j + 1)) \quad (8)$$

Clearly, the sum of the first (n – 1) terms, call it S_{n-1}, is finite. Then we look at the geometric progression formed by letting

$$a = t_n = 1 / (n\,(n + 1)) \quad (9)$$

and

$$r = t_{n+2} / t_{n+1} = n\,(n + 1)/((n + 1)(n + 2) = n / (n + 2). \quad (10)$$

Obviously, r is less than 1 for all values of n. Also, every term in the GP is at least as big as the corresponding term (that is, t_n for a, t_{n+1} for ar, etc.) in the original series defined by (8). The fact that we start at the n^{th} term does nothing to make the series less infinite. On the other hand, in proving the convergence, because the GP is convergent and every one of its terms is as big or bigger than every corresponding term in the original series, we have a means to compute an upper bound for the sum of the series (8) from term n onwards. Call this upper bound U. Its value is

$$U = a / (1 - r) = (1/(n(n+1)))/(1 - n/(n+2)) = (n + 2) / (2n\,(n+1)\,). \quad (11)$$

This gives us a method for approximating the sum to any accuracy we like. By requiring the remainder

$$R_n = t_n + t_{n+1} + t_{n+2} + \ldots. \quad (12)$$

to be less than some tolerance value V, we know that the value we compute for the sum is sufficiently precise. But R_n is less than U, so finding the value of n for which U is less than or equal to V tells us how many terms to include in the sum before we stop. The condition

$$U = V = (n + 2) / (2n\,(n + 1)) \quad (13)$$

turns out to be a quadratic in n, namely,

$$2\,V\,n^2 + (2\,V - 1)n - 2 = 0. \quad (14)$$

Before looking at the number of terms the quadratic tells us to include, let us try a very simple approach to the summation. In Basic, we can code the following program.

```
10 REM S = SUM 1/(i*(i+1)) FOR ALL i
20 REM INITIALIZE
30 LET S=0
40 LET i=0
50 REM TOP OF LOOP, COMPUTE TERM(i)
60 LET i=i+1
70 LET T=1/(i*(i+1))
80 LET S=S+T
90 IF S>S-T THEN 60
100 PRINT "SUM=",S
110 STOP
```

On a North Star Horizon running 8-digit Floating Point Basic (hardware arithmetic unit), this routine computes a sum of 0.9999273 in 176 seconds using 12910 terms. The last term is 5.9994837E-09, which is roughly half a unit in the last place relative to the sum. Of course, we are adding smaller and smaller terms to a sum having a value near 1.0. Summing the 12910 terms in reverse order yields a total of 0.99992254, deviating from the previous value in the 6th position. Note that the North Star uses rounded decimal arithmetic.

Returning now to the bound on the remainder after n terms, we can solve the quadratic equation (14) for various values of

V. Only positive roots are of interest. The program given in an earlier article yields the following results: V is the upper bound to the series remainder.

V	n
1E-4	5000.9995
1E-6	500001
1E-8	50000005
.5E-8	1.0000001E+8

Clearly, to get the answer to satisfy the upper bound criterion to a given tolerance requires that a great many terms be included in the sum. Since each term requires roughly 0.0136 seconds to compute and add into the series sum, a bound of 1E-8 would require 68,1640 seconds to compute the sum (backwards, of course). This is 189 hours, or over 1 week.

It turns out that the series defined by (8) has an easy to evaluate sum, and all this computation—real or implied—is unnecessary. Note that

$$t_j = 1 / (j*(j+1)) = 1/j - 1/(j+1). \quad (15)$$

Thus the series is just the sum

$$1/1 - 1/2 + 1/2 - 1/3 + 1/3 - 1/4 + 1/4 - 1/5 + \ldots = 1. \quad (16)$$

We therefore know exactly how much error there is in our summation. Unfortunately, our 8-digit calculation has error in the sixth figure relative to 1. Perhaps we can accept that this is good enough for most purposes, though for some applications like navigation, a higher precision result is desirable. In such cases, we must look for ways of bounding the remainder from below as well as from above. In the present example, the sum (16) is so easily found that the search for a lower bound is unfruitful.

Consider, as an alternative without analytic solution which has an easily computed value, the series defined by the j^{th} term

$$t_j = 1 / j^2. \quad (17)$$

This is a special case of the Riemann zeta function, which is defined for integer arguments k to be

$$\zeta(k) = \sum_{j=1}^{\infty} 1/j^k \quad (18)$$

(ζ is the Greek letter zeta.) Here we have introduced the sigma notation, which implies that we evaluate the expression to the right of the Σ (Greek captial sigma) for each of the integer values of the index, in this example j, starting with the value to the right of the '=' sign, in this case 1, up to the value above the sigma (in this case infinity).

Once again we could try direct summation, but in the same spirit as before, we shall look for bounds on the remainder after (n – 1) terms

$$R_n = \sum_{j=n}^{\infty} 1/j^2 = 1/n^2 + 1/(n+1)^2 + \ldots. \quad (19)$$

The series defined by (8) is an ideal tool for this purpose, since we can bound every term in the remainder R_n by noting that

$$1/((j-1)*j) > 1/j^2 > 1/(j*(j+1)) \quad (20)$$

for all j values. Thus

$$U = \sum_{j=n}^{\infty} 1/((j-1)*j) > R_n > \sum_{j=n}^{\infty} 1/(j*(j+1)) = L. \quad (21)$$

Using the same ideas given in equations (15) and (16), we can evaluate the sums U and L, the upper and lower bounds, as

$$U = 1/(n-1) \qquad L = 1/n \quad (22)$$

and estimate the infinite sum (18) as

$$Z = \sum_{j=1}^{n-1} 1/j^2 + (U + L)/2. \quad (23)$$

The truncation error, that is the theoretical error made in leaving off the terms in the infinite series which constitute R_n, is then at most

$$U - L = 1/((n-1)*n) \quad (24)$$

The rounding error is harder to estimate, but we can reduce the occasion for its occurrence by forming the sum part of (23) backwards from j = n to j = 1.

The following table presents some results of this approach in 8 digit Basic on a North Star Horizon.

n	Raw Sum	Correction	Estimated Sum	(U - L)
10	1.5397677	1.0555556E-01	1.6453233	1.111E-02
100	1.6348839	1.0050505E-02	1.6449344	1.010E-04
1000	1.6439336	1.0005005E-03	1.6449341	1.001E-06
2000	1.6444339	5.0012505E-04	1.6449340	2.501E-07
4000	1.6446840	2.5003126E-04	1.6449340	6.252E-08
8000	1.6448091	1.2500782E-04	1.6449341	1.563E-08
16000	1.6448716	6.2501955E-05	1.6449341	3.906E-09

Note the difference between the bounds goes to zero much faster than the value of the correction.

This is just one approach to this problem. The summation of infinite series continues to be a challenge to mathematicians. Brute force and ignorance are inefficient and/or inaccurate. Elegant methods require thought and effort.

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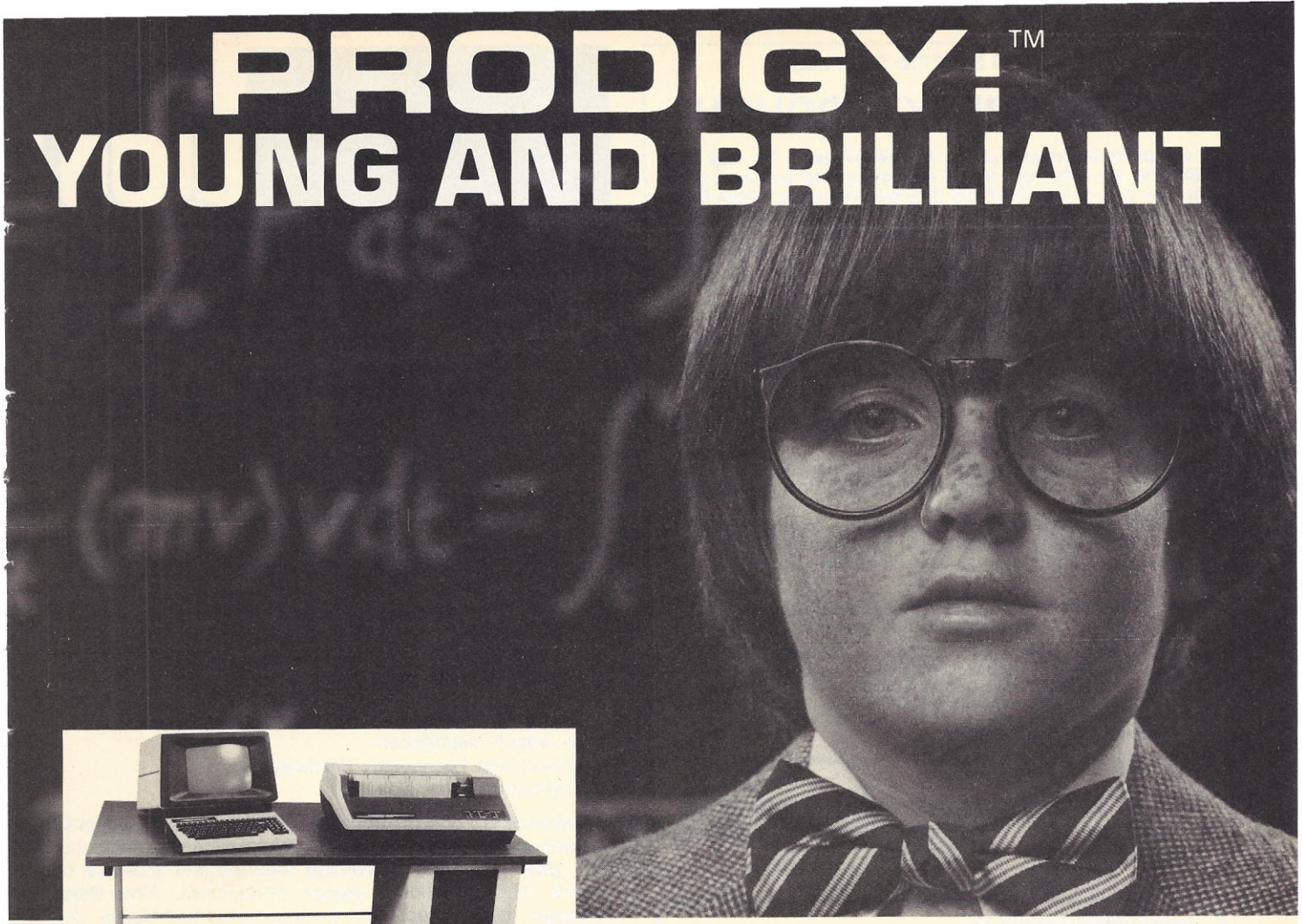

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Learning with Micros

by Louis E. Frenzel

Books About Computer Education

Those just getting started in the computer education field may want to take a look at some of the new books available on the subject. Books covering computer-aided instruction and related topics date back to the late 50s and early 60s. But you will probably be more interested in the more recent books that are also more relevant. Here is a list of several pertinent books published within the last year.

Computer-Assisted Instruction Using Basic
by John F. Huntington
Educational Technology Publications
Englewood Cliffs, NJ

This book is a good instruction to CAI for teachers, industrial trainers and other first-time users. It introduces the subject of CAI, gives a review of learning theories and provides an outline of instructional design procedures. The Basic language is covered and programming techniques are explained. The emphasis is definitely on those special procedures that apply to writing CAI programs. The examples given can be implemented on large scale computer systems or on micros with adequate mass storage capability. The book also has a good glossary and an extensive bibliography of related books and articles.

To date, I have found no other book on CAI that is as good a starting point for those just getting into teaching with computers. Most books on computers and education just tell what CAI is. This one actually shows how to write programs. The lack of depth may put off more experienced individuals, but you can't beat this one for an initial introduction.

Educational Technology also publishes at least a dozen other books on computers and education. Write for a complete book list. The company also publishes *Educational Technology* magazine, which frequently covers CAI and educational applications of computers.

Mindstorms
by Seymour Papert
Basic Books
New York, NY

Papert is a professor of mathematics at MIT and is generally well known in the field of computers in education. He is probably best known for the LOGO project. LOGO is a special, easy to learn computer language that is used in conjunction with a "turtle." The turtle is a robot-like device with wheels connected to it and controlled by the computer. With commands from LOGO, it can be instructed to move in any direction for a specific distance. Usually, a pen is attached to the turtle, so it draws pictures as it rolls.

The whole idea of this system is to teach children mathematics. Papert believes that children learn math faster and better if they command or program the computer rather than have the computer "program" them through CAI.

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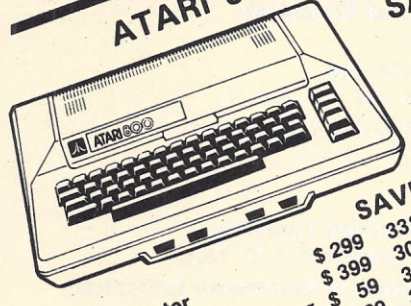

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Save.

This is all covered in *Mindstorms*. The book gives a good overview of the uses of computers in education. But the emphasis is definitely on the teaching of mathematics to children by computer. Many of his ideas are drawn from the theories of Piaget.

This is a good book; I recommend it.

The Computer in the School: Tutor, Tool, Tutee
Edited by Robert Taylor
Teachers College Press
Columbia University
New York, NY

This book is a collection of 19 articles on computers and education. It is really a history of this development. Most of the articles were written during the 70s by the five men who are generally recognized as the leaders and pioneers in the computer education movement—Alfred Bork, Thomas Dwyer, Arthur Luehrmann, Seymour Papert and Patrick Suppes.

The book discusses the role of the computer as a tutor, tool and tutee. As a tutor, the computer instructs the student by CAI. As a tool, it assists the teacher and the school in a variety of administrative and management functions. In the tutee mode, the computer is the one that is instructed. Here a case is made for teaching students to program.

It is a good review of what has happened with computers and education in the past decade by the men who made it happen.

The Third Wave
by Alvin Toffler
William Morrow and Co.
New York, NY

While this book does not specifically cover computers and education, it does have a message that is worth hearing. The book implies that computers could play a major role in the future educational process. For example, Toffler says that his concept questions the conventional notion that education must take place in the classroom. Why not mass education via computer or video over communications networks?

Toffler defines the first and second waves of our civilization as the argricultural and industrial revolutions respectively. Now, a new third wave is emerging. In the next decade or so, it promises to change our ways of working, living and thinking. It will change our economics, politics and education. Computers and communications networks will play a major role.

Toffler implies that education should be more individualized and not necessarily of the mass variety. Of course, this is where computers come in.

The book is worth reading.□

Here is a list of some other computer education and related books.

Computers and Education
by J. L. Poirot

Computer Literacy
by C. E. Horn and J. L. Poirot

Both by Sterling Swift Publishing
Manchaca, TX

Computer Assisted Learning
Edited by R. Lewis and E. D. Tagg

Microcomputers in Secondary Education
Edited by E. D. Tagg

Both by Holland Publishing Co.
Amsterdam, The Netherlands and New York, NY

Computer Based Instruction
Edited by Harold F. O'Neil, Jr.
Academic Press
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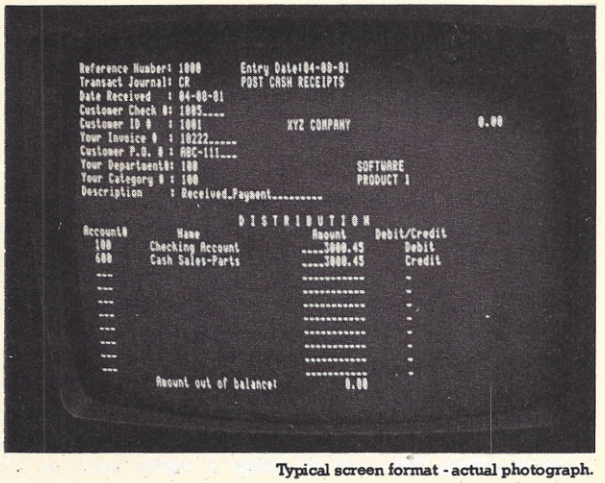

Typical screen format - actual photograph.

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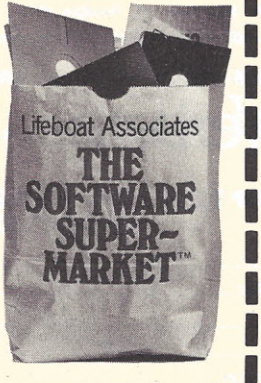

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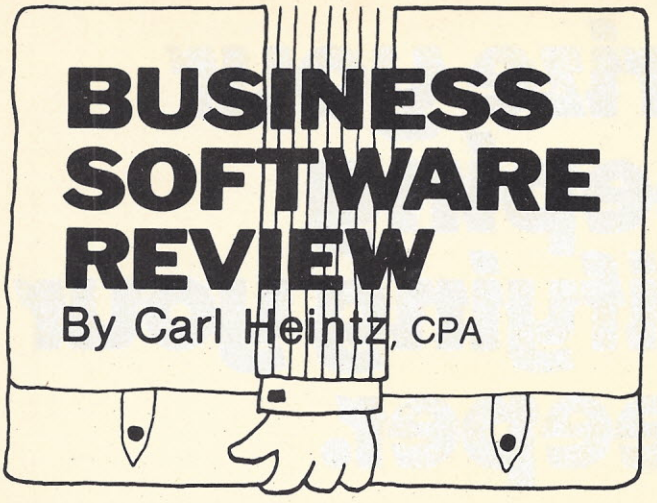


TIM—A Versatile Tool

A good package produced by Innovative Software, Shawnee Mission, KS is TIM (Total Information Management), consisting of a data base management system written in MBasic. It is designed to run on any Z80 or 8080 machine compatible with Microsoft Basic. The programs are available in a compiled form, which runs anywhere from 10 to 15 times faster than the interpretive Basic that most of us are familiar with. When I first investigated the package, I was skeptical of the ability of the programs to run efficiently due to the inherent complexity of data bases and the built-in speed limitations of Basic. There are no problems.

It is a very friendly program designed for the average user, rather than the experienced programmer. The manual is clearly written, well indexed and broken into logical chapters.

The package has a series of menus that guide the user through all phases of using the data base. The master menu, for example, contains the following.

A = ADD A RECORD
B = BUILD A SELECTIVE SUB-FILE
C = CREATE A FILE
D = DISPLAY DISK DIRECTORY
F = FORM LETTER GENERATION ROUTINE
I = INSPECT, EDIT, OR SEARCH A FILE
L = LIST FILE SPECIFICATIONS
M = FILE MAINTENANCE
P = PRINT REPORTS OR LISTS
R = RETURN TO SYSTEM
S = SORT A FILE
X = EXIT T.I.M

Each selection invokes a program to perform the particular function selected. The loading sometimes takes a while, particularly if the application computer's floppies are slow. On the system used for the review, the average was 8 to 10 seconds for a program to load and begin execution—not lightning speed, but more than acceptable.

Setting up the data file, or creating the data base is the first step. When this option is invoked, a submenu is displayed containing the following.

C = CREATE USING A LIBRARY FORMAT
D = DEFINE A NEW FORMAT
E = ERASE A LIBRARY FORMAT
I = INSPECT CREATE LIBRARY
L = LIST A FORMAT IN THE LIBRARY
X = EXIT TO MAIN MENU

One of the nice features is that every time a format is used, the user has the option of saving it in a library for future use or for use with other data bases. This is a great time saver and very convenient when the system is used frequently. Definition of a new format is really easy with numerous program prompts and a manual containing a good explanation of what each prompt means.

The package allows for edit of input information and has provisions for the standard numeric, alpha-numeric, and date format fields. It also includes a special field type for names, which allows the user to enter a name such as "Iam A. Computernut" in first, middle and last format field, but sort the name based upon the last name. The system works great as long as you don't put abbreviations or titles after the last name. If for example, you enter "George Able V.P." into the system, a sort on names alphabetically will place poor George with the Vs instead of the As where he belongs. Other than that, the feature is indispensable for producing alphabetical names without going through a lot of gyrations.

Calculated fields are also allowed, and up to four decimal places of precision may be utilized. The standard arithmetical operands (+, −, division, multiplication) can be used in conjunction with other fields or constants.

Key fields are used to keep the data base in a certain order. The system allows a user to define key fields at creation of a data base or later after data has been entered. The system also has provision for multiple key fields (major and minor), which allows a user to sort by more than one attribute and construct a multi-sorted data base. Further, later on, key fields can be changed. The package is very flexible and simple to use in this area and may be one of the best data bases around when it comes to flexibility in arranging and rearranging the order of the data base.

TIM was designed for business applications where reports and lists represent a major component of the data base output. The report generation routine includes a subroutine that allows users to create a number of report formats and store them for use on whatever database files he desires. There are actually two types of reports the program is set up to produce. The first is the standard report most data base systems include. Various column titles are defined and the data base elements are listed accordingly.

These report formats allow for subtotals and totals, and provide for such niceties as page numbering and up to six lines of report titles. The date may also be included in the report. There is even a feature that allows a user to enter data at the time a report is printed (with prompting from the computer). To make the users reports even more useful, there are many provisions for summary fields to be used in calculations made on the report at the time it is printed.

One of the best features of the system is the provision it includes for creating and maintaining lists, such as mailing lists. The system is configured so lists may be generated in any fashion, as many as four across, with almost complete control over formatting. This allows even the novice user to set up and generate mailing lists. The user can store various formats for lists for use on whatever data bases are applicable.

It's obvious that the authors tried the system out on users—they included a feature often missed in the most sophisticated of systems. When reports are being printed, the CRT displays the vital message: PRESS X TO STOP PRINTING. Besides saving time and paper, this little feature gives a user the feeling that he really is in control, after all.

No data base system is complete without provisions for editing, inspection and searching the data base. The menu for the program tells the story:

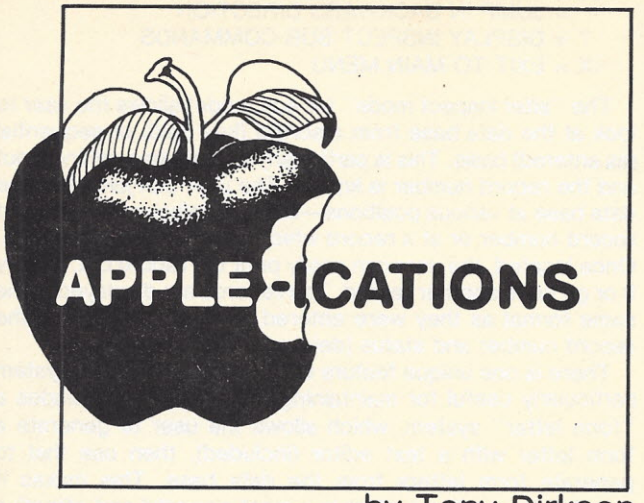
A = ALTER INSPECT MODE
D = DELETE CURRENT RECORD
F = GOTO FIRST RECORD
L = LIST FIELDS OF CURRENT FILE
N = GO TO RECORD NUMBER
P = PRINT CURRENT RECORD
R = RE-DISPLAY CURRENT RECORD
S = SEARCH FOR INFORMATION
U = UPDATE CURRENT RECORD
CR = STEP TO NEXT RECORD
+ = JUMP IN FORWARD DIRECTION
– = JUMP IN BACKWARD DIRECTION
? = DISPLAY INSPECT SUB-COMMANDS
X = EXIT TO MAIN MENU

The "alter inspect mode" (or edit mode) allows the user to look at the data base from a sorted (key field) or sequential (as entered) basis. This is particularly useful when editing input and the record number is known. The user can jump into the data base at various positions—the beginning, end, specified record number or at a record which matches search criteria. Once located, the user can easily print the record out, modify it or go on to another record. The records are displayed in the same format as they were entered, with the addition of the record number and status (deleted or not deleted).

There is one unique feature which should make the system particularly useful for maintaining mailing lists. It includes a "form letter" system, which allows the user to generate a form letter with a text editor (included), then use that to generate form letters from the data base. This makes it possible to use the system in a most powerful and effective fashion. For example, a user may wish to implement his accounts receivable. With very little effort, he can generate form letters for collections, advertising campaigns, even fancy statements. The ability to use multiple selection criteria and integrate all of the other features make the system impressive, indeed.

The system comes complete with several application examples. These include a mail-list system and some programs to do sales analysis. The manual contains some good examples that are appropriate beginning points for the user's specific applications. TIM is best suited for applications in which the requirements are relatively basic—no "multiple-file" or complex mathematical computational requirements. It is a data base system ideally suited for your basic, garden variety business applications.

TIM is a good product. It has an entirely different feel from many other products reviewed in past columns. □



by Tony Dirksen

The Computer-Assisted Doctor

When most doctors purchase a personal computer, they're making a business investment—buying a tool they can use to maintain billing records, keep schedules, and help them figure taxes. But as more medical offices become computerized, many doctors are discovering that those same computers can help them professionally as well. For some, the computer is an educational tool that offers them programmed seminars. For others, it's a diagnostic tool that helps them make better decisions for their patients.

Dr. Jeffrey Sue, a diagnostic radiology resident at Stanford University Hospital, Stanford, CA, had a head-start on most doctors, since he came to medicine with a master's degree in computer science. But when he bought an Apple II two years ago, he didn't yet have any specific idea how he'd use it professionally. "At first," he says, "I was just experimenting. I started with the minimum type of system—16K of memory and a cassette recorder for storing programs."

He upgraded quickly, however, adding a disk drive and building his memory capacity to 64K so he could write Pascal-language programs. "I personally prefer Pascal to Basic," he explains. "And I'd had experience with Pascal on bigger systems that could be transferred directly to the Apple."

Computers and radiology

Radiology has been radically changed by the computer in recent years, so much so that it's been suggested that the word radiology should be supplanted by the term diagnostic imaging. The role of the personal computer in the future of radiology, however, is still open to question.

Dr. Sue may have found one future direction. As a radiologist, much of his day is spent examining X-rays for the types of subtle traces that can define illness. A few times each month, an X-ray comes by his desk that seems to suggest some form of congenital disorder—a one-in-a-thousand problem created by damaged genes and characterized by abnormal bone structures. Often, these are X-rays of children's hands which were taken originally to determine whether their bones were growing and maturing at the proper rate.

It's been known for several years that some congenital disorders can be identified by doing pattern profile analysis of the hand; that is, by charting how the growth of a person's hand bones deviate from the normal rate of growth, and comparing that pattern of deviation to the patterns found in people with congenital disorders. The calculations, however, are tedious, and can easily take more than half an hour per X-ray.

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COMPARING WITH LARSEN'S SYNDROME
SIMILARITY R VALUE= 0.05
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COMPARING WITH PSEUDO &
   PSEUDOPSEUDOHYPOPARATHYROIDISM
SIMILARITY R VALUE=-0.10
```

Example of congenital syndrome comparison

To perform the calculations, the doctor must first measure the length of each of the 19 hand bones from the X-ray, look up the normal length of each bone for the patient's age and sex, then subtract that normal value from the measured length. Next, these values have to be divided by the standard deviation for each bone, again dependent on age and sex. Finally, the results are plotted on a chart and visually compared with charts of different congenital syndromes.

Thus, although it might be a valuable tool, pattern profile analysis is rarely used. Dr. Sue, however, recognized that it offered a perfect opportunity to put his computer to good use. "There are two main reasons computerization works well here," he explains. "First, because performing the calculations manually requires nearly 100 repetitive steps that can be handled automatically by a computer program. Second, because the relative pattern of bone size is more important than absolute measurements, allowing you to plot your results on a graph and make a visual comparison."

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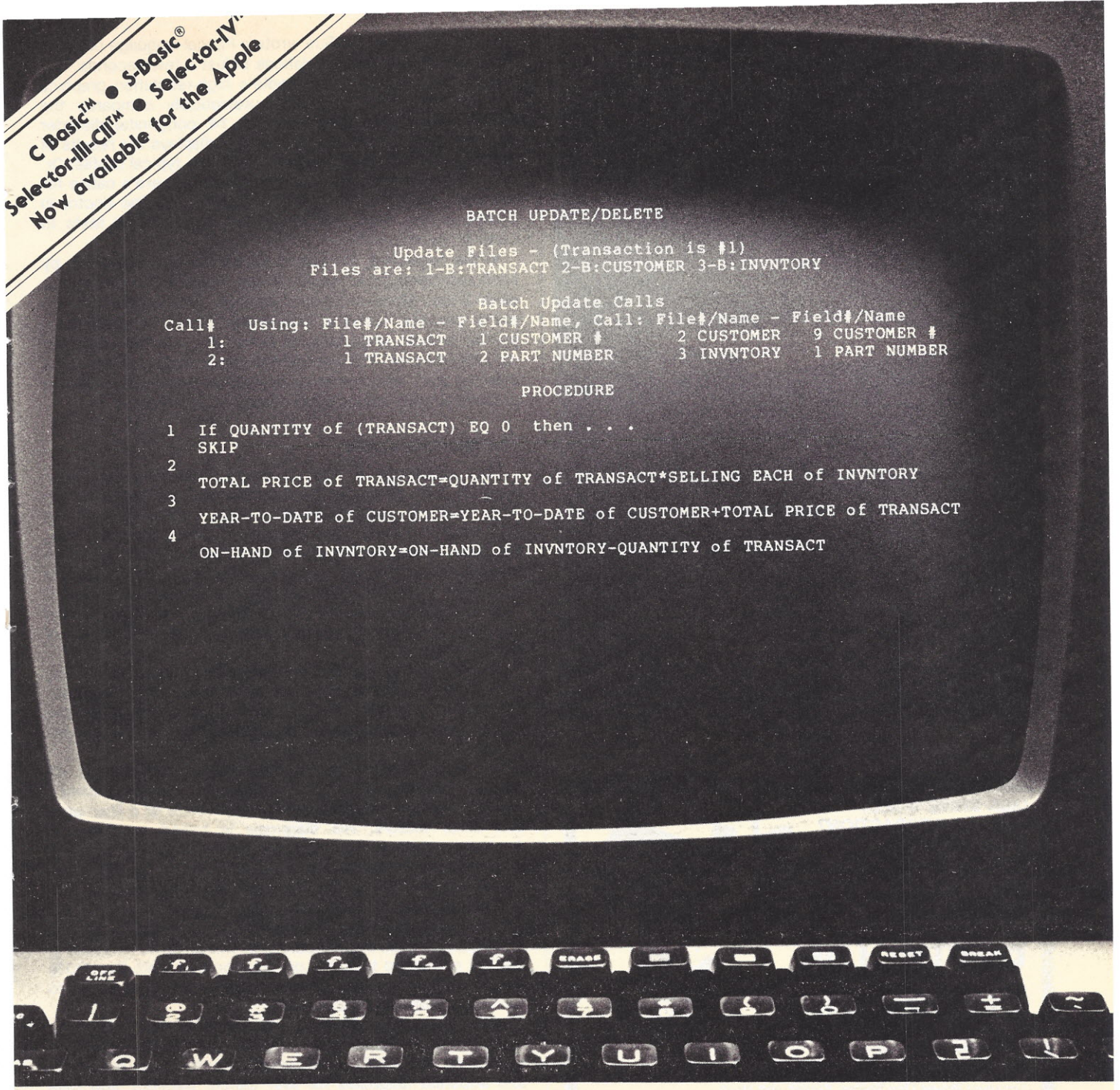

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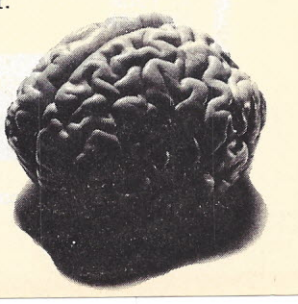

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Using his Apple, Dr. Sue wrote a Pascal-language program that performs all the calculations in just a few seconds, and charts the results on the Apple's high-resolution graphics screen. Then the computer automatically compares the pattern statistically with each of 14 congenital disorder patterns, and, if there are similarities, displays the results of the X-ray on the screen together with the typical profile. Dr. Sue compares the patterns. If he decides there's cause for concern, he prints the graph and gives it to the doctor in charge of the case, who may then do additional tests to confirm the diagnosis.

In the beginning, Dr. Sue made all the measurements by hand and typed in the results, which took about 5 minutes for each X-ray. More recently, however, he's automated the entire process. Using a VersaWriter tablet, he positions a pointer at both ends of each bone, and lets the computer calculate its size. The VersaWriter saves him time when he's entering data, and prevents the types of errors that can be associated with copying and recopying information.

The Shanghai Apple

One advantage of the personal computer over larger systems is its simplicity and its portability, which make it an ideal tool for doctors involved with community medical programs. Professor Tang Zhaoyou of Zhong Shan Hospital, Shanghai, China, was a winner of a 1979 Cancer Research Institute award for his success in the early detection and treatment of primary liver cancer. He received an Apple II Plus as a gift from the former president of the Institute, and has been working on ways to use it in different levels of clinical diagnosis.

Primary liver cancer is the most common cancer in China, with an incidence more than five times higher than in the U.S. Research performed in China during the early 1970s has helped to make early detection and treatment of the disease a reality.

Dr. Zhaoyou's method of diagnosis is built around 42 different parameters that are examined, including the patient's medical history, reported symptoms, results of a liver scan and other factors. His diagnosis is based on Bayesian Analysis, a method of determining the probability of a patient with certain symptoms having a disease when you know the probability of those symptoms occurring in that disease.

When he adapted his diagnosis technique for the Apple, Dr. Zhaoyou selected 18 of the most important questions so that a patient could be diagnosed in just two or three minutes. In its first controlled test, the program proved more than 90% accurate; they're now working on a more advanced version to be used in routine clinical work.

Although he admits to being a computer novice, Dr. Zhaoyou reports that his Apple was "easy to use." In the future, he says, "the Apple II Plus will provide a better chance of early and accurate diagnosis for liver cancer patients, and thus provide a better chance for early treatment of the disease."

Other applications

As personal computers become more common in medical offices, it's likely that these types of computerized diagnostic tools will become more readily available. Already there are programs written to monitor glaucoma patients, perform bone tumor analysis, interpret arterial blood gas reports and do ultrasonic imaging of the carotid arteries. In addition, many diagnostic programs are available on larger time-sharing systems that can be accessed by doctors who use their Apples as smart terminals.

A number of commercially available programs provide computer-based seminars and simulations that help doctors keep up with the latest medical developments.

From Stanford to Shanghai, the personal computer has begun to change how doctors treat their patients. It could well be the beginning of a new era in computer-assisted medicine. □

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  - Chart of Account Listings
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  - Trial Balance
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  - Order Entry
  - Prints Invoices
  - Aging (30-60-90 Days)
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- ACCOUNTS PAYABLE
  - Creates Purchase Orders
  - Cash Requirements Report
  - Prints Checks
  - Automatic Posting to G.L.
- PAYROLL
  - Payroll Register
  - Prints Checks
  - FDIC Form 501
  - 941's and W2's
  - Automatic Posting to G.L.
- INVENTORY
  - Raw and Finished Goods
  - Status Reports
  - Inventory Alert Reports
- FIXED ASSET
  - All Capital Goods
  - 5 Different Depreciation Methods
  - Depreciation Report (IRS Form 4562)
- MAILING LIST
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  - By Customer, Vendor or Employee
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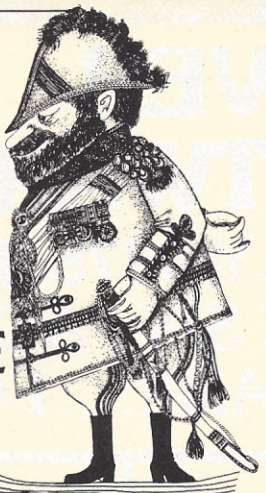
REQUIRES:
48K - C BASIC 2



THE COMMODORE LOGBOOK

by Mike Heck

Word Processing Craftsmanship

This column will spotlight interesting software applications and unique hardware configurations of the Commodore Business Machine (King of Prussia, PA) line of computer products.

Wordcraft 80 is a full feature word processing program designed for use on a Commodore 8000 series computer with at least 32K memory.

Both 4040 and 8050 dual disk drives are supported for loading the actual program and storing documents. With the 8050 drive, about 350 pages of text can be stored on a single diskette. The program can drive most letter quality printers (with the proper interface—usually serial or parallel). The 2022/4022, Mannesmann-Tally 8024 or other dot-matrix printers can be used for draft quality printing.

The program takes advantage of the 80 character wide display to show text on the screen formatted exactly as it will be printed. The actual page size can be set to a maximum 117 characters wide by 98 lines deep. The program will automatically scroll in either direction as text is entered, so you always know where you are on a page.

Supplies include a comprehensive user manual, the program on both 4040 and 8050 formatted diskettes, a set of training cards and a pocket reference guide of all control and command functions. When the program is first run, a list of printers is displayed, along with a letter code for either single sheets or continuous stationary in each case. Depress the key corresponding to your printer and paper type. After selecting the printer, the unit displays a blank page with the status area on top. This area is always present to guide the user and display necessary information.

Chaining chapters together

The first two display lines show the name of the document, date, file name it was saved under, document chapter, column the cursor is on, page, characters left for text entry and disk drive selected. The third line shows the mode you are in and any system messages. The fourth line includes entry of commands used for getting, saving and printing documents and data entry for items like document name, date, header/tailer information and strings to search/replace. The fifth line is known as the RULER and shows margins, tab stops and indention points.

Wordcraft uses the convention of breaking a document into chapters for text input and editing. However, all chapters can be chained together and printed automatically. With 32K of memory, 8-10 full pages of text can be in the machine at any one time.

The modes of operation include command (to store, recall, and print documents), type (the normal text entry mode) and control (to embed formatting controls within the text, and to perform text manipulation jobs like insertions and deletions).

Let's go through a few steps to get a feel for how the program operates. On startup, the program is in *command mode*. You can set the document name and date, get a document from disk or go directly into typing. The RUN/STOP key switches between the command and type modes. When you do depress RUN/STOP, the status line will change to *type mode* and the cursor will jump to the first line under RULER, ready for text entry.

Words not broken

The default margins will be set at column 5 and 78 and the page length is 55 lines. This is just about right for 8½ by 11-in. paper and leaves room on the top and bottom for page numbers and a header or trailer. Margins can be changed at any point within the chapter to alter formatting. For simple text entry, start typing. When the right margin is reached, the current word will not be broken; the whole word will be moved down to the next line if it doesn't fit.

Simple editing can be done by using the INST/DEL key to insert or delete characters. This works fine for small blocks of text, but gets cumbersome when large amounts are involved. For this, special controls are provided, especially for block manipulation. Since controls are embedded within the text to make the text conform to the printed page, you'll probably make constant use of this mode while entering and editing text.

The control key is the OFF/RVS key and when depressed, the status line will show *control mode*. Then, a second key is depressed to define the actual control operation. For example, to start a new paragraph hit OFF/RVS, then RETURN. This forces a new line. If you want to skip more than a few lines, an easier way is typing OFF/RVS, then + and the number of lines that should be skipped. This could be useful for inserting charts or graphs in text.

Basic text entry is straightforward with the display showing text in the format that it will be printed. Other control functions are used to insert or delete blocks of text, move text anywhere within the chapter, set tab stops or margins, search and replace text strings, set underlining or emboldening, and moving from page to page within the chapter.

Suppose you want to center a line of text. Depress OFF/RVS, then = (for equal spacing). The cursor will skip to the center of the line and any text typed will automatically stay centered on the line. If you want to center text that has already been entered, perform the above sequence and the existing text will move to the center of the line.

Another control that will be used from the start is the RULER. By going into control mode and depressing # (shifted 3), the message RULR will appear. To alter margins, move the cursor to where the new margins should start or end and enter a < or >, then OFF. The text will then be re-formatted to fit within the new margins and pages adjusted for the new length, if necessary. Tabs can be set in much the same way, from within the RULER, by hitting the ↑ (up-arrow) wherever a tab should be. In use, tabbing to any spot is done by OFF/RVS, then TAB.

Tab positions are also used to define indention points. To start indention at any of the set points the user types OFF/RVS then [(left-hand bracket), and text will be indented from the set point.

Now that text has been entered and edited, RUN/STOP is used to get back to *command mode*. Typing "s,text,1,1" tells the program to save the text as test on drive number 1 and as chapter 1. As more chapters of the same document are typed, a shortcut method of saving (or getting) documents can be used: type "s,,,2" and the new information will be saved as chapter 2 of the test document.

Wordcraft will automatically keep track of the page numbers within the whole document. Once a chapter is saved, the

page numbers are incremented from the last page number of the previous chapter saved. A chapter can also be inserted between two existing chapters and, again, all chapter pages will be properly renumbered. To recall the chapter, type "g,test,1,1" and the specified chapter will be recalled from disk. The document can now be edited some more or printed.

To print, type p from the *command mode* and the whole chapter will be printed. There are a number of options associated with the print command to specify only a certain number of pages, double spaced printing, emboldening rather than underlining, number of copies or global printing (automatic printing of all chapters in a document). For example, to specify printing of pages 4 through 8 with emboldening, the user would type "p,4-8,b" and only those pages would be printed, with emboldening in defined areas. Other print commands are in the same format.

There are a number of control functions designed to make complex editing much easier. Say you want to insert a large block of text. Position the cursor where the insertion should start, depress the OFF/RVS key and then INST (shifted INST/DEL). A section of space will be opened up in the text 5 as indicated by a section of underlines. Start typing the new text. When the end of the indicated space is reached, it will be extended automatically. When all text is inserted, type OFF (shifted OFF/RVS) and the remaining space will disappear.

Block deletion is done in much the same fashion. Position the cursor at the beginning of the block to be erased and depress OFF/RVS, then e. The message "block identify" will appear. Now, position the cursor at the end of the block to be erased and depress OFF.

The block identified will be immediately erased and any remaining text brought together. There is no limit to the size of the block that can be erased within the chapter. Pages or the whole chapter could be deleted. Block movement is done in basically the same manner, except after selecting the control mode, type m for move. After you identify the block to move, Wordcraft will print "block position." Position the cursor at the start of where the block should be moved and hit OFF again. The block will be moved from the original position and placed in the new area.

Separate paragraphs can be easily merged together to form complete documents. This might be useful for a lawyer putting together contracts, as just one application. Each paragraph would be saved as a separate page in a chapter. To merge the paragraphs together, type m (for merge) and the page numbers of the desired paragraphs (in any order) and those paragraphs will be merged together in the order specified.

Set up name and address file

The program also lets the user set up a form letter with fill points. In its simplest form, the fill point lets you insert information at pre-determined spots within a document without searching through, performing the normal editing insert function. This could be very useful for a small number of custom letters.

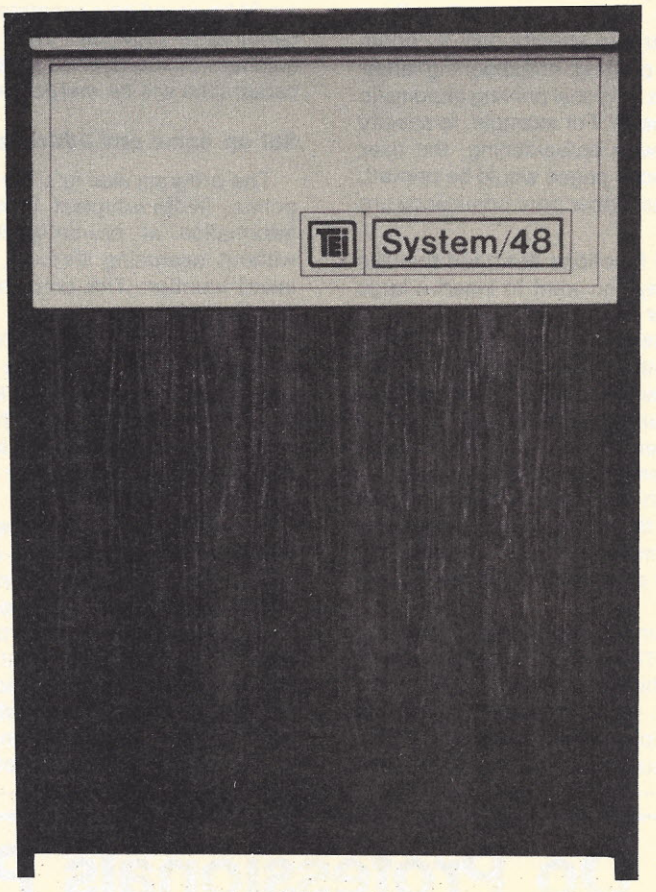
A more refined use is the ability to assign each point a unique code. Then, a name and address file could be easily set up and merged into the letter with a special fill command, which automatically fills in the information from the file in the proper spot within the form letter, justifies the remaining text, prints out the finished letter and starts the cycle again for the next name.

From within Wordcraft, the user can format blank diskettes, make backup copies, get a directory of what documents are stored on a diskette, or print the directory.

The program is a powerful, screen-based system that contains a full set of controls and commands that allow the user to perform just about any word processing function. Some additional functions include subscripts and superscripts, headers/tailers, automatically starting a new page when the page length is exceeded and background printing (printing a document while editing another). □

System of the Month

TEI System/48



by Tom Fox

Texas Electronic Instruments, Inc. has an identity problem. The full name of the company is too long to be used in conversation, and the initials TEI mistakenly evoke an Oriental origin. (There is no connection between TEI and Dallas-based Texas Instruments.) TEI (Houston, TX) has been producing electronic and mechanical components for several years. These devices have found their way into a wide assortment of computerized equipment.

With a building full of specialized sheet metal processing equipment and a special flair for designing precision power supplies, the company broke into the personal computer field a few years ago with an S-100 box—a chassis with built-in power supply and mother board. The design was a good one; it remains a favored choice even today.

When this evolutionary move came to pass, a strange defocusing of goals took place in the design department. In the past, we've had some harsh words to say about TEI's predilection for developing a confusing variety of computer designs; only to discontinue them after a few months of production—sometimes only of promotion. Our young industry does not need this kind of instability; buyers would like a computer product to stay on the market long enough so that "obsolete" does not mean that the manufacturer simply lost interest in making it.

Being survivor types, the TEI folk have apparently profited by their early experiences, and appear to have marshalled their forces. During the very time we were lamenting its expected demise from the computer scene, the company was quietly putting the finishing touches on the System/48—an elegantly conceived and soldily executed business-class microcomputer. The unit's most unique feature is that it is a multiprocessing system—that is, it contains two microprocessor computers. The micros work together to share the overall computing load for a number of simultaneous jobs or users.

The basic system consists of a single pedestal-like enclosure containing two microcomputers, a separate printer in a low-boy cabinet and a single cathode-ray tube (CRT) terminal. The printer is a 150-character-per-second dot matrix design built by TEI; the CRT terminal, one of the simpler offerings of Phoenix-based TEC. One of the microcomputers is dedicated to the internal needs of the system and the other is available to run business applications programs. Up to seven additional processors and terminals can be added, making the system into an eight-user multiprocessor.

Mention "System/48" and the image is that of deucedly clever packaging. Conceiving a usable package design for a computer is a lot harder than it looks to the uninitiated. The individual components

must not only operate properly when interlinked, but must have adequate provision for cooling, electrical shielding, maintenance access and noise suppression. To keep the sales department happy, a computer system must present an attractive, yet distinctive, appearance. Finally, the machinery must be housed so that the assemblage of component parts remains in reasonably close formation during the bumps it will have to endure during its lifetime.

The package achieves these goals with a deceptively simple elegance. All portions of the computer (except terminals and printers) are housed in a floor-standing cabinet roughly a yard square and four feet tall. The box presents a monolithic wood-grained face to all sides; its styling harmonizes with a line of computer furniture recently introduced by Samsonite.

The top foot or so of the cabinet front folds down to create a small desktop. This action reveals a brushed aluminum panel containing an opening for a floppy diskette and bare minimum of operator controls; power switches and reset buttons for each of the system's nine microcomputers.

Lift the top of the unit to gain access to the nine nearly identical plug-in single-board computers and double-density, double-sided floppy disk drive mechanism. Remove the rear panel to expose the 18M-byte Winchester-technology hard disk drive, hanging on an internal laminated wood panel. Open the front door all the way to see the other side of this panel, which has the remainder of the computer's components hanging from it. This includes a card cage with 11 identical power regulator cards, a generously-proportioned power distribution/fuse panel and one of the company's famous constant-voltage transformers. A pair of cooling fans imbedded into sheet metal ductwork maintains a flow of air over the system's heat-generating componets.

The components are shipped as a knocked-down kit, assembled on site by the dealer. The parts snap together without the need of tools. When the mechanical assembly is completed, a set of pre-formed wiring harnesses is laid in to tie the parts together electrically. Individual pieces can be removed for service just as easily. The entire package exudes a solid, almost military robustness.

"Silent magic" at work

The complex of parts that provide DC power to the computer elements begins with a TEI constant-voltage transformer (CVT). This is a large voltage step-down transformer incorporating an extra winding around a special iron core. The device goes a long way towards providing a constant output of AC voltage in an environment of varying input line voltages and/or unsteady loads presented by the downstream electrical elements.

This trick is performed with the silent magic of electromagnetics, and does not depend upon intricate electronic components that might be prone to failure or excessive heat dissipation. The only shortcoming of the CVT design philosophy is that it can play hob with the input power factor presented to the AC line during voltage extremes, something that is of practical concern only with much larger machinery.

The CVT performs the rough regulation of AC power. Final conversion to direct current (DC) and its precision regulation is a job given over to a group of 11 individual regulator cards. Each card produces the four separate voltages needed by the other system components. The efficient method of ultrasonic switching regulation is utilized for the high current +5-volt supply. The regulator circuitry incorporates overvoltage and over-current sensing, as well as automatic shutdown features. There is a regulator card to supply the hard disk, one for the floppy diskette drive, and one for each of the nine processor cards. All regulators are identical in design, substantially easing the problem of spares provision.

Tradeoff for longevity

Most microcomputers of modern design perform the final, precision regulation of DC power via specialized integrated circuits contained on the CPU or memory cards themselves. This plan has the advantage of simplicity in power distribution design, but carries the penalty that substantial heat is produced in close proximity to the sensitive computing circuitry. The company has chosen to forsake this design shortcut in favor of the more complex concept described above. Service life of the electronic circuitry is sure to benefit as a result.

Up to nine separate microprocessor cards may be inserted into the main card cage. Each is a stand-alone single-board computer that includes the central processing unit (CPU) as well as all necessary memory and input/output (I/O) circuitry. The main microprocessor is an Intel 8085, a popular development of the pioneering 8080. The 8085 chip is designed to run any program coded for an 8080, incorporates more functions within a single chip, runs several times faster (5 MHz in this case) and is cheaper to build in the bargain.

Each of the processor cards contains 64K bytes of dynamic random-access memory (RAM), as well as 2K bytes of read-only memory (ROM). The latter contains the card's bootstrap loader program, and is equipped with "phantom" circuitry, so that it effectively disappears from the RAM address space when its function is completed (a few seconds after boot-up). There is no provision for further expansion in memory size on the processor cards.

Each processor card also contains two complete serial I/O ports, as well as a single parallel one. The parallel port and one of the serial channels are intended for connection to a "local" printer; the remaining serial port wires directly to an ordinary CRT terminal.

The processor cards connect together via a deceptively small flexible cable lying across the top of the nine cards. The only other electrical connections to these cards are DC power and the serial and parallel I/O channels. One of the cards is designated the master, and can be distinguished by an extra handful of chips installed in one corner. This additional circuitry connects the master processor to the disk drives, and is not needed on the remaining processor cards. Other than this detail, all cards are physically and functionally identical. Each normally operates with the same operating system software resident in its individual RAM, although one can imagine more complex arrangements that would work.

The master micro card has the responsibility of transmitting data to and from the floppy and Winchester disk drives. Further, it is empowered to police any conflicting requests for these resources from the

remaining eight processors. Additionally, the master processor manages the common system printer via a special spooling program. The spooler was not available at the time we tested the system, so we can't describe the exact workings of this important program. In concept, any of the eight applications processors can instruct the master (via a request on the high-speed inter-processor bus) to read one or more disk files, and send them to the system printer. The system printer is the one connected to one of the three I/O ports on the master processor card. In addition, any or all of the eight applications processors can be fitted with its own local printer.

The whole arrangement effectively removes a large processing load from each of the applications processors, and places it on the shoulders of a single, hard-working dedicated processor. This frees each local processor to perform its assigned duty. The most dramatic result is that a heavy processing load on one of the eight applications micros is absolutely unfelt by any of the others. Each processor works in utter isolation, insulated from the travails of its neighbor. This design represents a fundamental departure from the more common multi-tasking computers that time-share the resources of a single processor. The latter arrangement will often bog down under heavy processing loads. This is particularly true if the computer is fitted with but a single 8-bit micro. Sixteen-bit designs usually have greater reserve power, and are able to handle more users before performance degradation becomes a problem.

Processor power, however, is not the bottleneck in many business applications for microcomputers. The disk drive is normally the culprit here, since these programs routinely spend a lot of time shuffling data back and forth between the processor and disk surfaces. When several jobs compete for the limited time availability of a single disk drive, the contention problems often result in one program waiting for another to finish with the disk. The multi-processor design of the system is of no particular help in this matter, although other features of hardware and software design have been incorporated to minimize contention as much as possible.

Each of the micros runs with its own resident copy Magic, the company's proprietary operating system. It occupies about 18K bytes of the available 64K-byte RAM space on each card, and can be described as a "CP/M lookalike," at least at the operator interface level. Boot an applications card, and the familiar A> will appear on the attached terminal. The system will then honor most commands familiar to CP/M users, and handle them in pretty much the expected manner. Just under the surface, however, Magic is marching to an entirely different drummer, at a beat entirely of TEI's devising. The disk file directories, for example, are maintained within the imbedded ISAM structure, so that filenames are always shown in alphabetical sequence.

The operating system was designed so that any of the thousands of available CP/M-compatible programs will run on the system without modification. At least, it will run those programs that adhere to normal CP/M rules. There are a few applications programs on the market, however, that bend the rules a bit in an attempt to be more clever than their competition. We would not advise the purchase of a CP/M program for

the System/48 until its operation on the machine has been demonstrated.

Each package is delivered with the Magic operating system, two versions of Basic, two simple text editors and a data base management program called DataMagic II. The data base management system (DBMS) must rank as only ordinarily amazing in these days of extremely capable software. It allows you to create a CRT screen design for data entry, access the data in a variety of ways and create customized reports containing the data or manipulated derivatives of it. It doesn't take a programmer's skills to do all of this; just one who is familiar with the business application at hand, and who has the ability to wade through the 100-page manual. As a bonus, this DBMS includes a program that will generate the skeleton of a Basic program to work with the files created by DataMagic. A simple question-and-answer dialogue gives this program enough information to automatically produce the starting point for a custom applications program in Basic.

A lot of the DataMagic programs are written in Basic. This causes some initial surprise until you realize that these are merely "front-end" programs, which act as a way of communicating with the indexed-sequential access method (ISAM) imbedded into the operating system. DataMagic II is not simply a program that runs on the system; it is a choreographed cooperation that works intrinsically with the systems software.

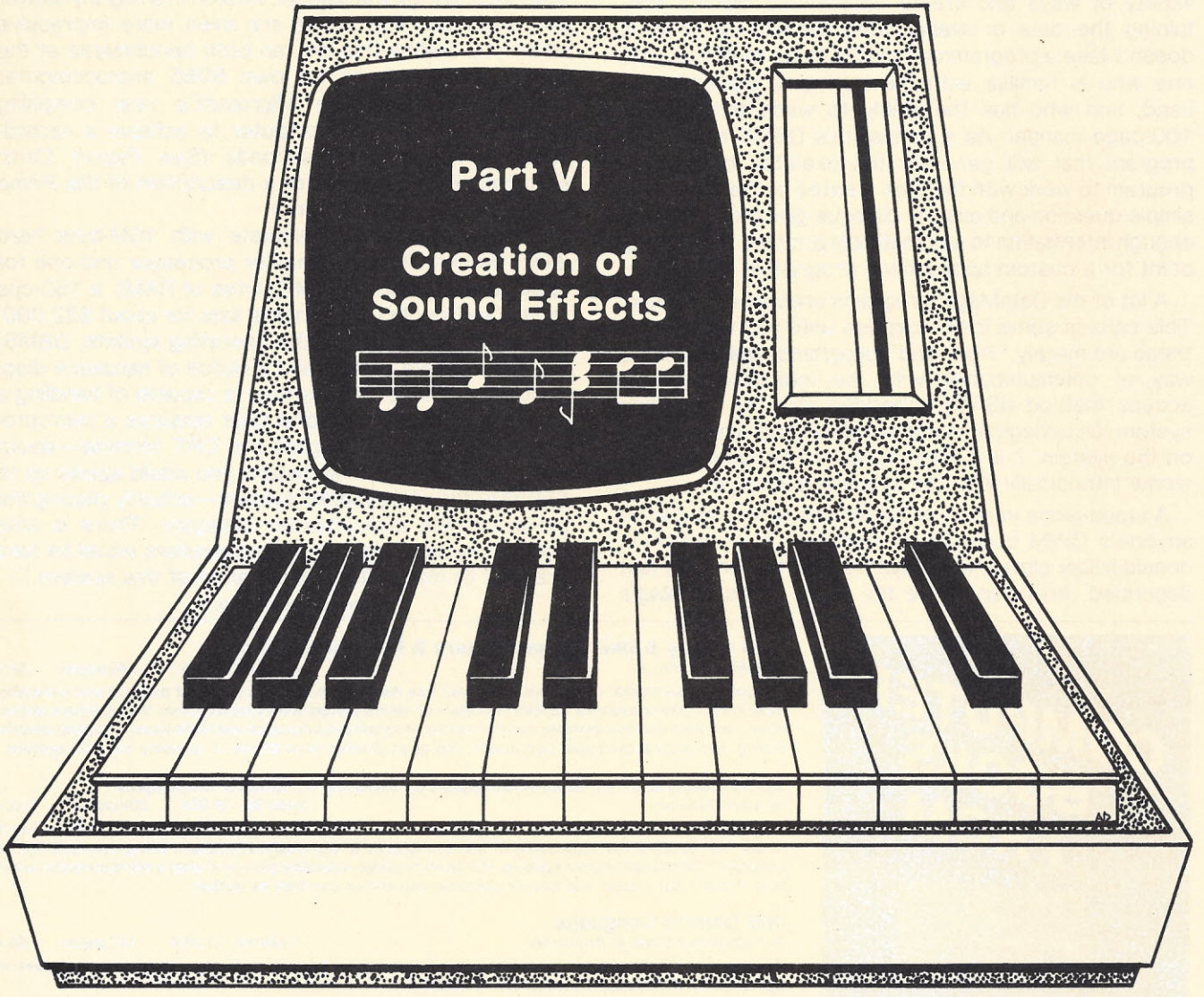
A stand-alone version of DataMagic which will run on anyone's CP/M computer is available. This version is considerably slower in operation than the one we just described, however, since the ISAM tricks of Magic have to be simulated by the program itself—a fate shared by any DBMS that runs on CP/M.

Two Basic interpreters are shipped with this computer: an ANSI standard version and an extended one called TBasic. Both were developed by Microsoft, so similarities far outweigh any differences. Both Basics run extremely fast—they rank near the top of all 8-bit micros we have tested. Our Prime Number Cruncher benchmarking program was handled easily by TBasic in 636 seconds; by the simpler version in a slightly slower 691 seconds. The marks are even more impressive when you realize that we ran both benchmarks at the *same* time—each on its own 8085 microcomputer card. We cranked up Microsoft's new compiling Basic-80 5.0 on this computer to achieve a record-breaking run of 178 seconds (See *Report Card: Benchmark* on page 74 for a description of the Prime Number Cruncher program.)

The basic system, complete with 18M-byte hard disk, 1M-byte floppy, a master processor and one for applications (each with 64K bytes of RAM), a 150-cps printer and single CRT terminal lists for about $22,000. The price also includes the operating system, DBMS, two Basics, two editors and a clutch of hardware diagnostics programs. This system is capable of handling a single user. Each additional user requires a microprocessor card, regulator card and CRT terminal—about $4,000 for the lot. This means you could spend up to $50,000 for a fully loaded system—actually placing the system in the minicomputer category. There is little doubt, however, that many minicomputers would be hard pressed to match the performance of this system. □

CIRCLE INQUIRY NO. 2

Sounds of the Atari ...in Basic



by Herb Moore ©

This series has tried to provide some techniques for generating different types of sounds with the Atari 400 and 800 computer using the Basic language.

Since I've communicated what is important from my own viewpoint, I've tried to provide techniques for creating sound rather than rules for composition. Hopefully, you will follow the spirit of the time and build your own creations.

In conclusion, I would like to describe two more sound effects that can easily be created with Atari Basic, and then present a brief composition using these techniques.

In the SOUND statements, I've been pretty consistent in leaving the variable for tone at a value of 10, something like the following.

```
100 SOUND 0,121,10,10
```

This generates a tone from which it seems to be easiest to create a timbre at least reminiscent of conventional acoustic instruments. Other values for tone give an assortment of buzzing sounds. Some can be used to create some interesting effects. For example, try the following.

```
10 SOUND 0,121,4,10
20 GOTO 20
```

The result is nothing special, but by using a decay loop for the loudness variable, you can create the sound of an explosion or a volcano erupting, as in the following example.

```
10 FOR L = 15 TO 0 STEP -1
20 SOUND 0,121,4,L
30 FOR T = 1 TO 50:NEXT T
40 NEXT L
```

I'll leave it to you to experiment with variations of this. One possibility might be to introduce different voices with varying attack and decay.

Another interesting effect results from using two voices with adjacent note values to create a kind of phrase shift as each note is periodically out of phase with the other. This is perceived by the ear as a single tone with a periodic variation in amplitude. The following program will let you hear this effect.

```
10 SOUND 0,200,10,10
20 SOUND 1,201,10,10
30 GOTO 30
```

The periodicity of this amplitude shift increases with an increase in frequency of the tones used. To hear an example of this effect, enter and run the following program.

```
10 FOR N=200 TO 10 STEP -10
20 SOUND 0,N,10,10
30 SOUND 1,N+1,10,10
40 FOR T=1 TO 1000:NEXT T
60 NEXT N
70 GOTO 10
```

If you listen to this for a while, you'll hear a pulse in the tone that occurs about three times in the lowest tone—the tone that introduces the cycle. This pulse will gradually speed up as the pitch of each tone becomes higher.

About a third of the way thru the sequence, you should be able to count four pulses, and a little later, five pulses, and so on. At the upper pitch in the cycle, the ear begins to blend the two tones into one again.

The reason for this phenomenon is that the number of times per second that two tones, very close to each other, will be out of phase is dependent on their wavelength.

Lower pitched tones have a longer wavelength and therefore complete their cycle less times in one second. Thus two low tones will only be out of phase a few times per second, whereas the higher pitched tones pulsate more rapidly because of their shorter wavelength.

These pulses are called beats in the jargon of psychophysics. You might be interested in knowing that your piano tuner uses these beat frequencies in tuning your piano. But that's another topic.

The following program exemplifies an artistic application of the two techniques. The theme is something of a fantasy representation of the development of a mountain range. Of course, this particular mountain range evolves rather quickly, hence the name Mt. Quick.

```
10 REM ***MT QUICK
30 GRAPHICS 24
31 COLOR 1
32 SETCOLOR 2,6,2
40 A=70:B=80
41 GOSUB 3000
50 N1=243:N2=242
60 GOSUB 5000
65 A=90:B=75
80 GOSUB 3000
85 FOR T=1 TO 2000:NEXT T
90 GOSUB 4000
100 A=120:B=50
110 GOSUB 3000
120 N1=242:N2=243:N3=144
130 GOSUB 5000
140 A=140:B=30
150 GOSUB 3000
160 GOSUB 4000
170 A=200:B=40
180 GOSUB 3000
190 N1=242:N2=243:N3=244
200 GOSUB 5000
210 FOR T=1 TO 3000:NEXT T
215 GOSUB 4000
220 A=225:B=50
230 GOSUB 3000
250 GOTO 250
3000 FOR CYCLE=1 TO 20
3005 X=INT(300*RND(1))
3010 Y=INT(80*RND(1)+100)
3020 PLOT X,Y
3030 DRAWTO A,B
3040 NEXT CYCLE
3050 FOR Z=1 TO 50
3060 N0=INT(30*RND(1))
3100 SOUND 0,N0,10,14
3110 NEXT Z
3120 SOUND 0,0,0,0
3200 RETURN
4000 FOR L=15 TO 0 STEP -1
4010 SOUND 1,N1,0,L
4020 SOUND 2,N2,0,L
4030 SOUND 3,N3,0,L
4035 FOR T=1 TO 100:NEXT T
4040 NEXT L
4050 RETURN
5000 FOR L=0 TO 15
5010 SOUND 1,N1,10,L
5020 SOUND 2,N2,10,L
5030 SOUND 3,N3,10,L
5040 NEXT L
5050 RETURN
```

In the main body of the program, fixed plot points are designated by such lines as 40, 65 and 100. These fixed points are the mountain peaks. Subroutine 3000 plots 20 random points and then draws lines from these points to each fixed point. Thus, each time the program is run, the mountain peaks are the same, but there will be some slight variation in the overall shape of mountains.

The loop in lines 3050-3110 plays a sequence of 50 very high pitched notes very fast. There are no graphics going on at this time, since I wanted the notes to be played as rapidly as possible. Whenever you introduce graphics commands in a loop like this it slows things down considerably.

In subroutine 4000, note values for voices 1, 2, and 3 are determined at lines 50, 120, 190 and so on. These notes are turned on with a slow attack loop. This, as you recall, will result in a gradual fade in of the sounds for these voices. The reverse process occurs in subroutine 5000, creating a slow fade out of these voices.

Of course, as you can see from looking back at the main body of the program, these subroutines are used at different places. By separating the subroutines for the attack and decay cycles with the RETURN statement at line 4050, it is possible to leave these three voices on while other things are happening on the screen. □

Does Price Reflect Performance?

Series 1 Results
Systems up to $15,000

	C-3 Accounts Receivable Time	Current Price
Pertec PCC 2000	6:04.3	$12,470
North Star Horizon	1:57.7	$ 6,911
Cromemco System Two	2:48.0	$10,180*
Texas Instruments Model 771	3:38.1	$12,100
Vector Graphic System B	5:56.5	$ 8,995
DECstation 78	5:04.8**	$10,495

*Cromemco has upgraded its system and increased the price since the tests. System Two now has built-in "self-diagnostics," quad capacity disks, and printer with upper and lower case.

**Includes both compile and run time

by Hillel Segal

Cost-effectiveness. Price-performance ratio. These are buzzwords of budgeting...the heart and soul of business judgement. But how can you apply them to the world of computers, where so many variables interact to create a workable system?

This is a question we have taken seriously in running benchmark studies of small computer systems, but we have pointed out that speed is not the sole selection factor. The Association of Computer Users' findings are intended to be used in the context of a complete analysis of the user's needs and the computer's hardware and software capabilities.

Still, the run times for standard benchmark programs do furnish a solid basis for comparing one system's throughput with another's. We focus on the accounts receivables test in this series, as it is the most appropriate test of a business application.

The test systems generally offered a 64K-byte central memory, CRT with keyboard, dual floppy disk drives and printer. Each has varying capabilities. Some CPUs are more powerful and faster than others, and some disks hold more information.

But software is as crucial to system capability as hardware. Many systems use standard operating systems such as CP/M, for which interpreters for almost any language and numerous specific application programs are available. Other computers may have an operating system with special characteristics for an intended application.

Following is a summary of the benchmark reports covered up to now in this series.

Texas Instruments 771. Benchmark clockings showed the system gave a good performance in the accounts receivable test. The 64K-byte memory leaves the user only 17,778 bytes after operating system and Basic are loaded. On-line disk storage maximum is .5M-bytes. The 771 supports several ports, but only the master terminal may be used to write programs.

TI offers no applications programs, providing two languages for development, TPL and Basic. The TI Basic has a virtual array file structure that accesses disk-stored data easily, some structured programming statements, and breakpoint and trace debugging features.

The editor left the competition far behind in the ease-of-use test, which counts the number of keystrokes required to make a standard set of program modifications. It needed only 143 keystrokes to do the job; other Basic editors took up to 230 strokes.

Vector Graphic System B. This system offers a versatile and inexpensive computer. System B finished next to last in A/R time, due to mediocre disk speed, but proved in other tests that it has a quicker than average CPU. The system leaves 48K bytes for the user when running Basic. Incorporating an S-100 bus, System B accepts add-on boards to allow many special configurations. Floppy disk storage can be extended to 1.26M bytes with a second set of drives.

A variety of operating systems, including CP/M, can be used. The Basic-80 that comes with the system allows some structured programming, immediate mode commands, assembly language subroutine calls and line renumbering.

North Star Horizon. Benchmark results showed outstanding power for the price in a flexible but technically demanding system. Run time for the A/R program was not only best of the class, but also beat all the $15,000 to $25,000 computers tested in series 2. The Horizon was at or near the top in all timing tests, due in part to its floating point arithmetic option, which performs some calculations with hardware rather than software. The modular S-100 bus hardware permits a wide range of disk, memory, clock, D-to-A converter and other additions. Accessible memory is 56K bytes, with expansion possible. Hard disk storage is also offered.

The operating system supports the firm's Basic and Pascal languages, but CP/M is also available for running other tongues. One inconvenience: the system does not allocate files dynamically, so size must be specified before beginning work. The Basic editor was rated low in keystroke efficiency.

The Horizon's system design makes an experienced programmer advisable. Documentation tends to be written for such a user and the personalization process during installation is rather complex.

Pertec PCC 2000. A reliable and expandable system especially notable for first-time users, this system was not, however, especially fast. Pertec's engineers felt the fair to poor showing on some tests resulted from an automatic "read after write" verification, which they considered a significant feature. Depending on specified file size, 28 to 34K bytes of memory remains for the user when Basic is loaded. Pertec can provide fixed disk storage of up to 40M bytes for the PCC 2000, and as many as five programming terminals can be hooked into the processor.

Pertec produces its own Basic and offers several business-oriented software packages. The system runs under CP/M. While users were generally pleased with the software, a number said the documentation was too technical for the inexperienced.

Digital Equipment Corporation Decstation 78. DEC accommodates business computer users with its Decsystem and Decstation models. The wide range of applications software is easy to use and the company has a good reputation for client training and service.

The system does not have to be personalized. It uses a compiled version of Basic, which is accurate up to 16 digits in its arithmetic. The system also has handy file management programs and a powerful string processor. Test times, which included both the compilation and run steps, were average.

In contrast to many systems, CPU memory was 32K bytes, and a Basic programmer is left with only 16K bytes at his disposal. Hardware problems were noted by some users with the disk drives.

Cromemco System Two. This system might be especially suitable for businesses storing a lot of data, since it can be expanded into a Z-2H with hard disk drive. The A/R time was excellent even with the system's floppy disks.

The semi-compiled Basic allows considerable structured programming statements. A good debugging facility, line-by-line syntax check, global change capability and call command were other features noted. The Cromemco disk operating system can be paired with three versions of Basic, plus Cobol, Fortran, Ratfor and a macro assembler. As with several other manufacturers, our surveys of users of Cromemco equipment turned up some grumbles about overly technical documentation.

As we've seen, performance—at least strictly in terms of speed—does not always reflect the price tag. Except in large number-crunching operations, the under-$15,000 micros' times are generally comparable to those of the $15-25,000 tested in series 2 of the reports.

Does that mean the more costly systems are not worth it? Not necessarily. Factors unrelated to speed may be just prominent enough on a particular shopping list to justify a higher price tag.

Upcoming are benchmark reviews of the Apple II+, TRS-80 model II, and systems by Digital Micro, Data General, Alpha Micro and Ohio Scientific. □

Hillel Segal is president of the Association of Computer Users, a non-profit association with members all over the U.S., Canada and several other foreign countries.

One of the association's key activities is the publication of its Benchmark Reports. Each month a new report is produced covering a computer system.

In addition, ACU publishes seven bimonthly newsletters for users of small computers, midi computers, large computers, time-sharing systems, distributed processing systems, word processing systems and home and hobbyist computers.

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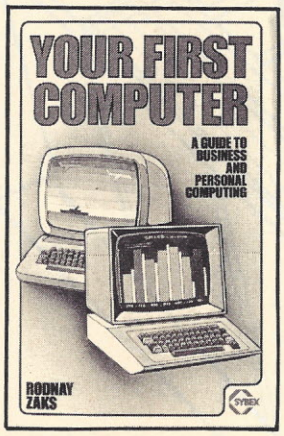

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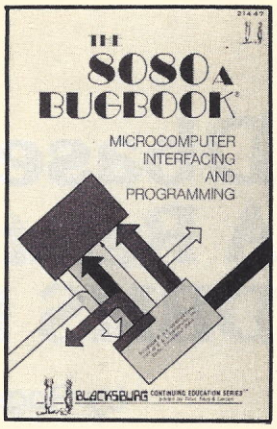

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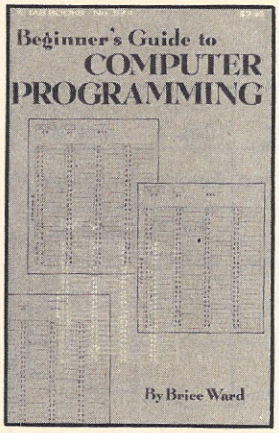

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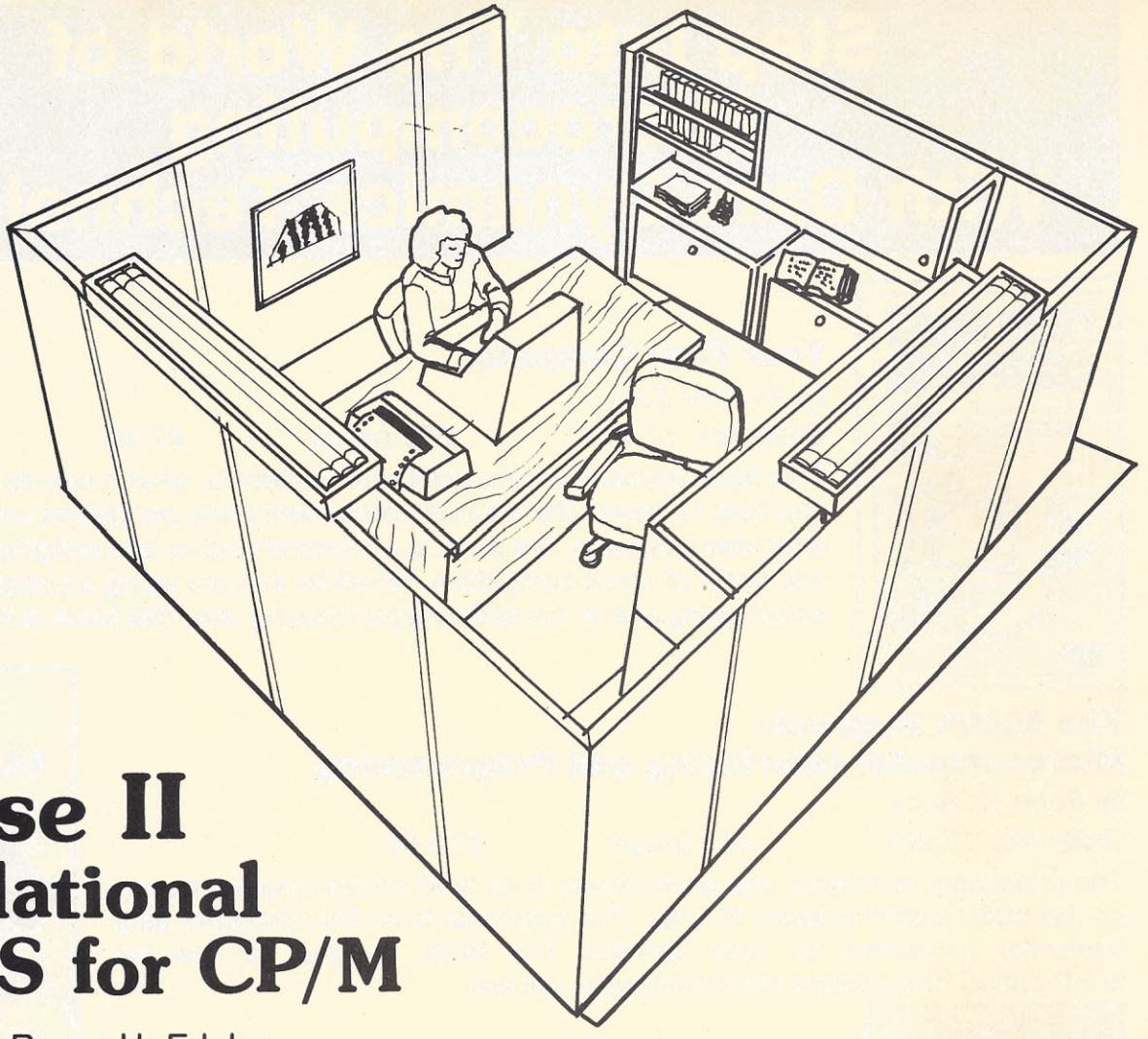

Dbase II
A Relational DBMS for CP/M

by Roger H. Edelson

Database management is where the action is happening today. The recently available database management systems (DBMS) allow the small businessman to quickly utilize his computer system and use it efficiently—not just as a file handler but as an information manager/reporter. Because of the importance of the DBMS concept, this month I will depart from my normal hardware evaluation to review Dbase II, a relational DBMS from Ashton-Tate, Los Angeles, CA.

Dbase II is a tool that allows easy manipulation of small and medium sized quantities of information (databases), either interactively or with English-like command programs.

Your computer system must meet the following minimal requirements:

- An 8080, 8085, or Z80 based microprocessor.
- A minimum of 48K contiguous bytes of memory. (Dbase II uses the locations from 5CH to A400H, but will treat disk as extended memory storage.)
- CP/M operating system (version 1.4 or 2.X).
- One, or more, mass storage devices operating under CP/M (usually floppy disk drives, but hard disks are certainly suitable).
- A cursor addressable 24 line by 80 column CRT, if the full screen editing operations are to be used.
- Optional text printer (for setting up some command files).

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Figure 1. Two dimensional data representation

As a relational system, it does away with sets, linking pointers, etc., which can quite quickly turn the job into a nightmare of managing the DBMS, rather than the information. Data is represented in the fashion shown in figure 1. Each row across the table is called a record, and each column of the table is referred to as a field. The order in which the records and rows are entered does not matter, but each element in the field column must be of the same type, i.e. you can't mix SUPPLIERS with AMOUNTS.

Now that we have some idea as to the relationship used to store data items, we can review the specifications for this system to see if they will meet your application. While the system will handle a large amount of information, its capacity is not infinite, and we are dealing with a micro-based system. The major specifications include: records per database file—65,535 max; fields per record—32 max; characters per record—1,000 max; characters per field—254 max; and numeric accuracy—10 digits.

Looking at the number of records per file and the maximum number of characters per record, we can see that the system will handle up to 65M bytes of information in one file, a rather impressive amount. Of course, if you are using floppy disks, this will take quite a few diskettes and some sophisticated instructions to allow the program to access and manipulate that much data. In almost all real-life situations, it will not be necessary to so severely tax the system.

Before we delve into the actual operation characteristics, let's review what data base management is. It goes beyond file handling and actually processes, or manages, the information (read data-base) for the various file manipulating programs. The DBMS, by treating all data in the same consistent arrangement, with file-to-file compatibility, allows each operating program to work with the entire information bank. This eliminates forcing payroll programs to just access payroll files and accounting programs to just access accounting files.

The two different information handling architectures are shown in figure 2. The major advantage is that all the data base is available to each operating program, rather than having to duplicate portions of the payroll file if this information is needed by the accounting programs.

Also, when generating a new processing system, although it is still necessary to write a new access or operating program, it is not necessary to restructure, or recopy any of the data. It is all available. When

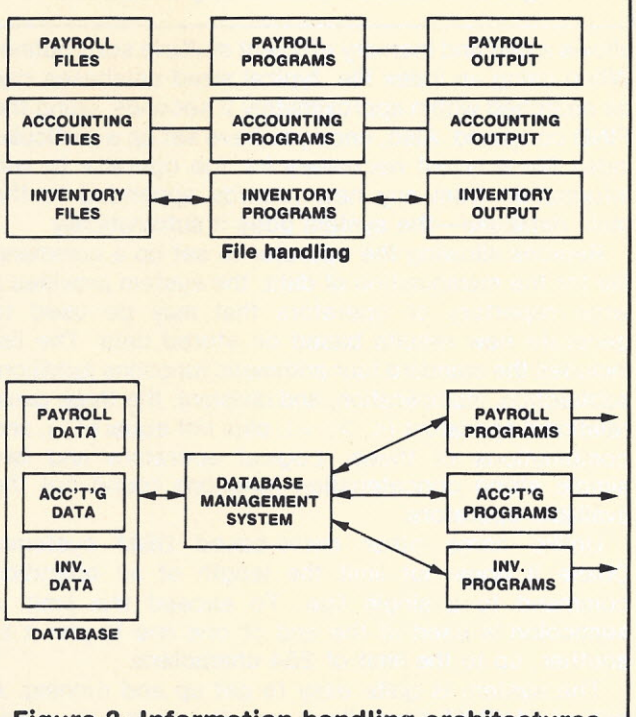

Figure 2. Information handling architectures

```
USE MoneyOut
DISPLAY STRUCTURE
STRUCTURE FOR FILE:  MONEYOUT.DBF
NUMBER OF RECORDS:   00000
DATE OF LAST UPDATE: 00/00/00
PRIMARY USE DATABASE
FLD     NAME       TYPE WIDTH   DEC
001     CLIENT     C    004
002     JOBNUMBER  C    003
003     BILL DATE  C    006
004     SUPPLIER   C    020
005     DESCRIP    C    010
006     HOURS      N    006    002
007     EMP NMBR   C    002
008     AMOUNT     N    009    002
009     BILL NMBR  C    006
010     CHECK NMBR C    005
011     CHECK DATE C    006
```

Figure 3. Sample record structure

business needs dictate adding a different type of data to an already existing record, there is no need to change any operating programs. If these programs don't require the new data, they won't see it. In a file-handling environment, it would be necessary to rewrite the programs themselves.

Since the main use of a DBMS is to manipulate files of information, the first step is to set up the appropriate data files. In this system, it is done with the CREATE command. When you use this command, the system responds with the prompt FILENAME, so you can name the file to be created. The usual CP/M limitations apply here. The name must start with a letter, cannot be more than eight characters long, and may have no colons. Once you have named your file, the file creation process starts. You are requested to describe your field structure within the organization shown on the screen, simulted as follows.

```
Create
ENTER FILENAME: AnyName
ENTER RECORD STRUCTURE AS FOLLOWS.
  FIELD  NAME,TYPE,WIDTH,DECIMAL PLACES
  001
```

Field names may be up to 10 characters long, may be either upper or lower case, may have embedded colons, but must start with a letter. You then describe the type of data, either character—C, numeric—N, or logical—L. The field width can be as long as 254 characters, but, if it is numeric, the number of decimal places must be specified. Allowance must be made for the decimal point, which takes up one character space.

Figure 3 illustrates a sample record structure as given in the operating manual. In the first attempt to enter record 005, the field name exceeded the 10 character limitation and the program indicated this error and allowed reentry. It would have been slightly easier if only the erroneous structure needed to be corrected, but this is hardly a major difficulty. When finished with the record structure setup, the operator hits CR to terminate this portion of the create command. The system then prompts with: INPUT DATA NOW?. Since it isn't necessary to enter data at this time, we will leave this function and look at the command function.

While inputting data to a file structure is obviously the first step in a DBMS environment, the real test comes when it is necessary to change, manipulate, and output it. In these areas, Dbase II really shines. You can work interactively with your data base using conversational, English-like commands.

CREATING FILES
- CREATE sets up new structured databases
- COPY copies databases, their structures, or their data to a new file
- REPORT generates information to your specifications, selecting only the information you want, with or without totals and sub-totals
- SAVE copies memory variables to a file for later use
- INDEX creates an index file for faster data location

ADDING DATA
- APPEND adds records onto the end of a database
- CREATE allows data entry when the file is created
- INSERT puts records into a file

EDITING DATA
- EDIT alters specific database records and fields
- REPLACE changes the contents of specified fields
- CHANGE edits specified fields in the database
- DELETE marks records for deletion
- RECALL erases the deletion mark
- PACK deletes the marked records

DISPLAYING DATA
- DISPLAY and LIST show records, fields and expressions
- ? shows the value of variables or expressions
- REPORT formats and displays data according to specifications, with or without totals
- READ shows prompting information and data
- SUM totals the fields you specify in a database
- TOTAL totals specified fields to a new database

FILE MANIPULATION
- DO starts execution of a command file sequence
- APPEND adds data from other files (even non-dBASE II)
- SELECT switches between two databases in use
- SORT organizes the database sorted on a field

MEMORY VARIABLE COMMANDS
- ACCEPT stores character data for later use
- INPUT accepts character, numeric or logical data
- WAIT accepts a single character input
- GET works like the INPUT command, used in the interactive full-screen entry mode
- SUM saves totals to memory variables
- SAVE stores memory variables in a disk file
- RESTORE retrieves the stored memory variables

OTHER COMMANDS
- FIND locates an indexed record, typically in less than 2 seconds
- LOCATE finds records that meet specified conditions
- SKIP moves you forward or back in the database
- DO WHILE allows repetitive operations
- IF....ELSE allows you to make choices

Figure 4. Dbase II commands

The list of available commands is shown in figure 4. It has been divided into sections under headings which relate to the particular task to be accomplished. For example, under the file creation subset are commands that allow creation, copying, modification and various other control orders. Some command classes allow various methods for displaying or manipulating the files. An additional class of commands assists in the control and usage of command files, those command strings which the user sets up to manipulate the data files.

The system allows full screen operation, with X-Y cursor positioning for setting up customized formats for either entering or reporting data. The functions of the cursor control keys are very similar to the functions used in other popular programs with slightly different meanings for some of the keys. The cursor control key functions are shown in figure 5.

While most of the command functions are self descriptive, some are not easily understood. INDEX is used to generate an index file which allows rapid sorting and data retrieval. Using indexing, the operator sets up a file using only the keys for which you might want to search for information. (Keys are database fields that are descriptive of the record, i.e. in a personnel file, the employee name and/or payroll number would probably be used as the keys in an index file.)

The advantage occurs because only the keys are included in the index file, rather than the entire contents of the database. The keys are organized with pointers to the record from which they were derived. The index file is organized in a structure called a B*-tree, which

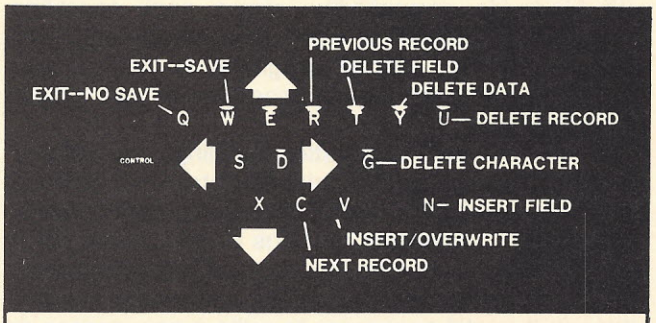

Figure 5. Cursor control key functions

allows a fast and memory efficient multiple sort routine. When using an index file, typical sized databases can be searched within approximately 2 seconds, using the FIND command. Also, once you have set up a particular index file it is not necessary for the operator to add information from any new records appended to the main database—the system does it automatically.

Besides allowing the operator to set up a command file for the manipulation of data, the system provides a large repertory of operators that may be used to generate new results based on stored data. The list includes the standard four arithmetic functions (addition, subtraction, multiplication, and division), the three usual relational operators (<, >, =), plus not equal (<>), and combinations of these. Logical operators and two simple string concatenation functions round out the available operators.

Unlike some other micro-based DBM systems, Dbase II does not limit the length of an operation command to a single line. To exceed this limit, a semicolon is used at the end of one line to join it to another, up to the limit of 254 characters.

The system is quite easy to get up and running. A pair of SUBMIT files allows you to use it with either CP/M 1.4, or version 2.2. These files allow you to

```
A> INSTALL

dBASE II INSTALLATION PROGRAM  VER 1.9

ARE FULL SCREEN OPERATIONS WANTED (Y/N)? Y
SELECT TERMINAL TYPE
A - HAZELTINE 1500          B - SOROC 120, 140, TELEVIDEO
C - HEATH 89                D - PERKIN ELMER FOX 1100
E - ADM-3A                  F - ADM-31
G - VDP-80                  H - INTECOLOR
I - GNAT-SYSTEM 10          J - TRS-80 II PICKLES&TROUT
     Z - USER SUPPLIED TERMINAL CHARACTERISTICS

J

ENTER A CHARACTER TO BE USED FOR INDICATING MACROS
OR A RETURN FOR DEFAULT CHARACTER OF AMPERSAND (&)

TYPE A RETURN IF THE ERROR CORRECTION DIALOGUE IS TO
BE USED OR ANY OTHER KEY IF NO DIALOGUE IS WANTED  _
```

Figure 6. Sample install display

switch back to either CP/M version at a later date. Once the appropriate SUBMIT file has been run, the operator types INSTALL to customize the system to his particular system. After this command is entered, the screen will display a set of prompts that allows the user to either select, or not-select, full screen operations and a specific terminal characterization.

The complete screen display is illustrated in figure 6. Note, that entering a Z to the SELECT TERMINAL TYPE prompt will lead you through another set of prompts that allow the installation of custom terminal characteristics. Then the system will be set up for your particular configuration. The INSTALL routine need never be run again, unless it is necessary to change the terminal type or the system defaults. To run the system for the initial trials, the user brings up the program by typing dBASE.

The above easy-to-follow description is characteristic of the 200-page manual provided. It is unusual in that it is actually two separate manuals combined. The first manual was apparently written by a first time user with little experience in the field. Its style is conversational and easy to read with interesting tips on improving your results.

The second part, written by the program's author Wayne Ratliff, should be used when generating your command programs to provide a guide for the exact syntax. It would be difficult to use this section as a guide to persons just starting out with the system. An earlier version of Dbase was released with just this section, causing many calls from frustrated users. The addition of the first section of the manual has solved this problem.

The system is compatible with ASCII files and can probably read your already established files and add the data to its database. The company also allows you to try out the software for 30 days. If, for any reason, you find it unsuitable, you may return it for a full refund.

This may not be the perfect DBMS for the micro arena, but it will do for a long time—at least until the 16-bit machines show up. Especially for job costing and proposal bidding applications, it really proves its worth. □

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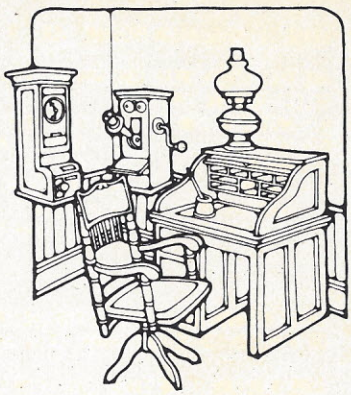

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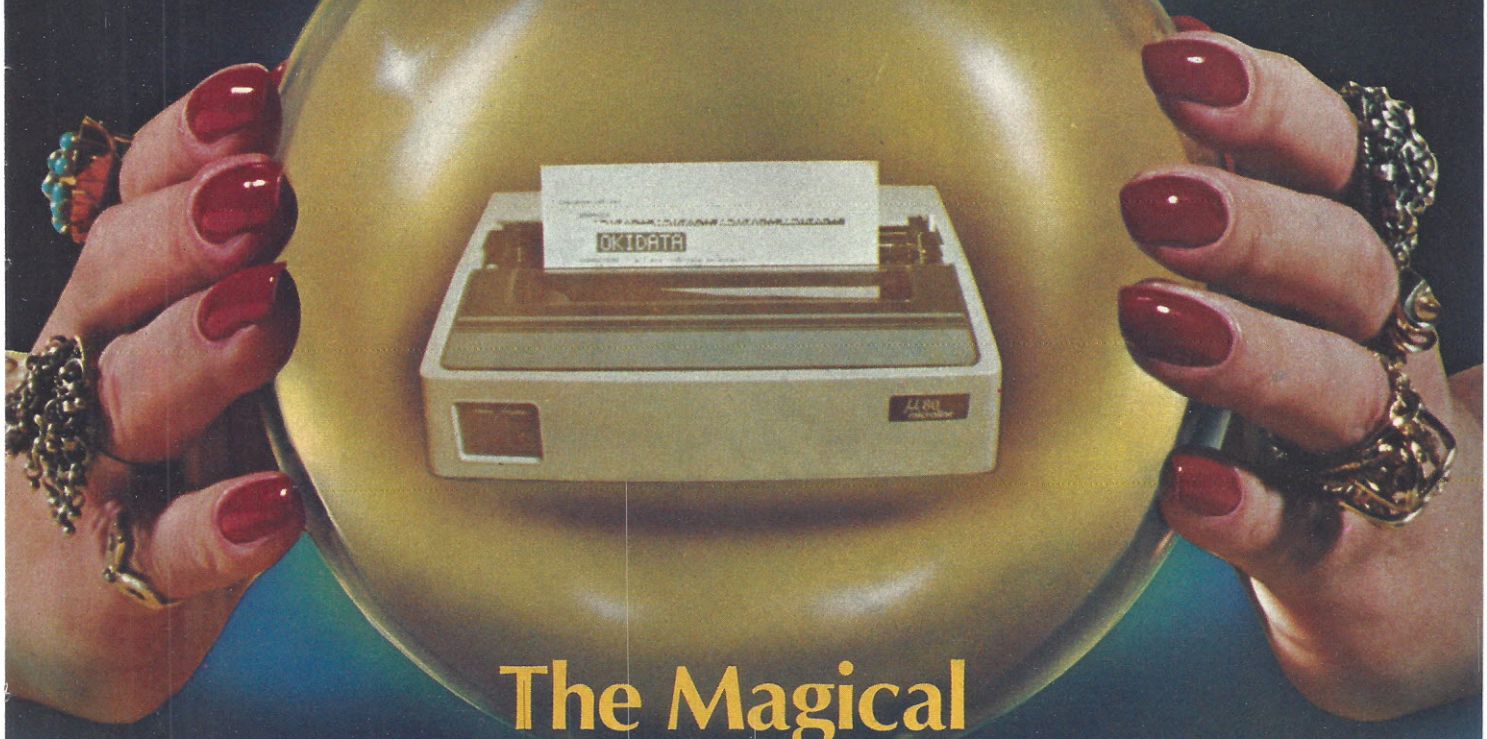

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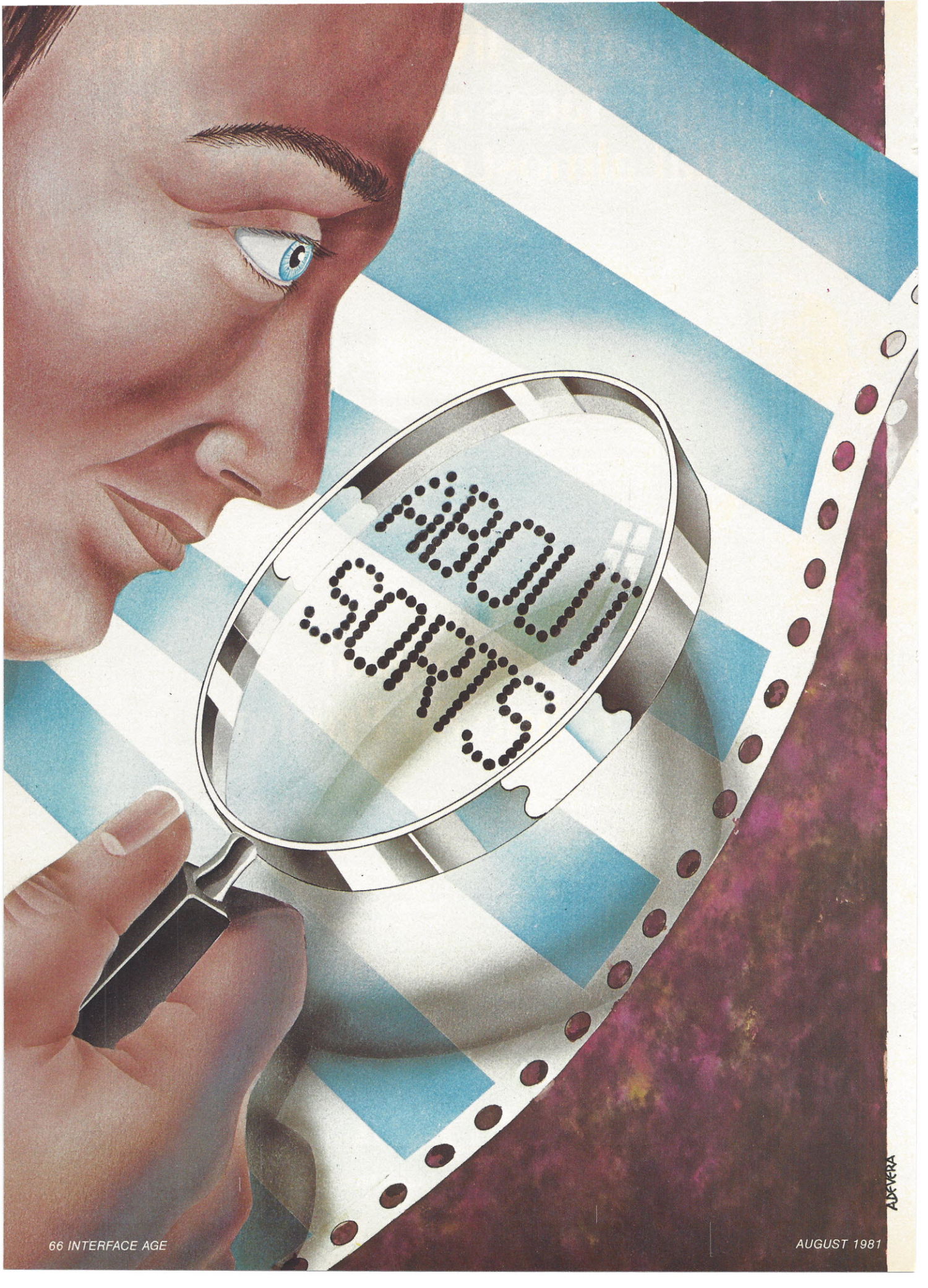
PERSONAL
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ABOUT SORTS

by Gene Cotton

This two-part article will investigate single table sorting techniques, using standard algorithms and the Basic language. The developed routines should work on any computer system and require only minimal modification for implementation in any version of Basic. The first part will review the simpler, slower methods and introduce the first improved method, the Shell Sort.

Whenever a list of items is rearranged into some other sequence, the list is said to have been sorted. The requirement for some other order can be demonstrated by considering a list of names, addresses and phone numbers. Suppose the list is compiled by asking the next 100 people encountered for the information. The list would not be in any kind of usable order; however, the list could be rearranged into alphabetical order by last name. It is important to notice that the related items of address and phone number would also be rearranged.

To investigate sorting, it is useful to discard any common parts or actions and to concentrate on those elements unique to the sorting process. Since the sorting process is based on the field of information that is ordered (the name, for example), the presence of other fields is unimportant. Ordering is based on the comparison of two different things. The two things could be names (as in the example) or numbers. The list could be ordered from the Zs to the As as easily as the traditional way. This investigation will consider a list of numbers to be ordered into ascending sequence. The programming examples will be written in Basic, but they are easily implemented in other languages.

A list of numbers is in ascending order when each pair of adjacent numbers is in ascending order. Consider the following list.

4 10 16 22 28

Since 4 < 10, and 10 < 16, and 16 < 22, and 22 < 28, the list is in ascending order. If some pair of elements in the list is out of order, the list is out of order.

4 10 22 16 28

This is true because 4 < 10, 10 < 22, but 22 > 16. To be in descending order simply requires the reversal of the above lists and the reversal of the signs < and >.

To write meaningful programming examples there is a support task that must be defined. To have a list to sort requires that a routine be written to provide such a list. In Basic this might be the following:

```
10 N = 12
20 DIM A(N)
30 FOR I = 1 TO N
40 A(I) = INT(1 + 1000*RND(1))
50 NEXT I
```

This routine will build a table of numbers with N elements (in this case N equals 12). Each number will be in the range 1 to 1000. The numbers will be in random sequence. This routine will be assumed present in all future Basic programs.

The definition of order suggests the first sorting method. A program written to step through the list from the first to the last element and correct any pair of elements found out of order.

```
120 FOR I = 1 TO N
140 IF A(I) ⩽ A(I + 1) THEN 190
160 REM SWAP THE TWO ELEMENTS
190 NEXT I
```

It is not practical to allow the comparison of A(N) with A(N + 1), so line 120 must be changed to allow only N – 1 compares.

If the comparison at 140 is true, the elements are in order, and no action is necessary. But if the comparison is false, line 160 is intended to be the routine to correct the order of the numbers.

Swapping two elements of an array is analogous to exchanging two drawers in a file cabinet. One of the drawers is removed and placed temporarily on a table; the second drawer is removed and placed into the vacant slot of the first drawer. The first drawer is then recovered from the table and placed into the vacant slot of the second drawer. By performing 3 moves, two elements are exchanged or swapped. Line 120 is changed and line 160 is replaced with the swap routine.

```
120 FOR I = 1 TO N – 1
140 IF A(I) ⩽ A(I + 1) THEN 190
160 T = A(I)
170 A(I) = A(I + 1)
180 A(I + 1) = T
190 NEXT I
```

This works for the list:

4 10 22 16 28

but fails on a list like:

20 14 28 22 16 10

After this routine has operated on this list, the result is:

14 20 22 16 10 28

This list is still not in order. The 10 at the end of the list should be first in the list. The 10 did move closer by one element position, so if the routine is executed four more times, the 10 will be in its proper place. No element in the list can be more than five moves from where it belongs. In general, a list of N elements will require no more than N – 1 executions of the routine. The first sort method then becomes:

```
100 REM SORT METHOD ONE
110 FOR J = 1 TO N - 1
120 FOR I = 1 TO N - 1
140 IF A(I) ⩽ A(I + 1) THEN 190
160 T = A(I)
170 A(I) = A(I + 1)
180 A(I + 1) = T
190 NEXT I
200 NEXT J
```

To compare the performance of this method for different-sized lists and against any other methods, a simple count of activities is devised. The number of comparisons at line 140 and the number of times two elements are swapped in 160 through 180, are both counted and reported at the end of the routine.

```
100 REM SORT METHOD ONE
110 FOR J = 1 TO N - 1
120 FOR I = 1 TO N - 1
130 C = C + 1
140 IF A(I) ⩽ A(I + 1) THEN 190
150 S = S + 1
160 T = A(I)
170 A(I) = A(I + 1)
180 A(I + 1) = T
190 NEXT I
200 NEXT J
900 PRINT "NUMBER OF COMPARES: ";C,
      "NUMBER OF SWAPS: ";S
```

This will keep track of the number of compares and swaps with each method. It is also useful to time each sort. This can be done by stopwatch if there is no timer capability on the computer used.

Analysis of method one indicates that the number of comparisons C will be (N – 1)(N – 1). The number of swaps S cannot be larger than C, but the exact number will depend upon the original placement of elements. At each comparison-swap step, an out of order element is moved one position closer to its ordered position. During each pass of the list, the numbers seem to ripple as they all move one step closer to the position they belong.

An example of sort method one is given for a short list of numbers.

```
Pass 1   16  30  86  10  56
         ^   ^
             ^   ^
                 ^   ^
                 10  86
                     ^   ^
                     56  86
Pass 2   16  30  10  56  86
         ^   ^
             ^   ^
                 10  56  86
Pass 3   16  10  30  56  86
         ^   ^
             10  16
                 ^   ^
                     ^   ^
                     ^   ^
Pass 4   10  16  30  56  86
             ^   ^
                 ^   ^
                     ^   ^
                     ^   ^
Final    10  16  30  56  86
```

Analysis of the above process points out an interesting fact. At the end of the first pass, 86 is moved to the end of the list. In pass 2, 56 is compared against 86 again; however, 86 must be the largest number in the list, or pass 1 would have pushed some other number to the bottom. This means that at the end of pass 1, the largest number in the list is pushed to the bottom and need not be checked again. Pass 2 could have considered the list to be one element shorter. At the end of pass 2, the largest element of the remaining list would have been pushed to the bottom of this shorter list, that is, to the second to the last position in the original list.

The list of numbers could be treated as a series of successively smaller lists, with the largest element settling to the bottom of each pass. This shifting effect can also be visualized as small light elements bubbling to the top of the list. Hence, this method is sometimes called a Bubble Sort. The changes to method one occur in lines 110 and 120:

```
100 REM SORT METHOD TWO
110 FOR J = N - 1 TO 2 STEP - 1
120 FOR I = 1 TO J
130 C = C + 1
140 IF A(I) ⩽ A(I + 1) THEN 190
150 S = S + 1
160 T = A(I)
170 A(I) = A(I + 1)
180 A(I + 1) = T
190 NEXT I
200 NEXT J
```

In method one, the number of compares was calculated as N – 1 compares each of N – 1 passes. Method two requires the summation of N – 1 compares with N – 2 compares with N – 3 compares down to 1 compare. Turn this sequence around and get the sum of 1 plus 2 plus 3 plus ... plus N – 2 plus N – 1 compares. The formula for the sum of the first m numbers is m(m + 1)/2. The number of compares in method two is then: (N – 1)N/2. This is approximately half the number of compares required in method one. This will shorten the time required to sort a list.

The exchanges still occur at adjacent elements, and no improvement in the number of swaps is possible. The maximum number has been reduced, since the number of swaps cannot exceed the number of compares.

There is still another improvement that can be made. If the list is in order to begin with, the number of

compares will be the same, even though the number of swaps will be zero. If a flag is introduced to detect the fact that no swaps have occurred during the most recent pass, the routine can be terminated. The changes to method two occur in lines 115, 185, 195, and 210.

```
100 REM SORT METHOD THREE
110 FOR J=N-1 TO 2 STEP -1
115 F = 0
120 FOR I=1 TO J
130 C = C + 1
140 IF A(I) ⩽ A(I+1) THEN 190
150 S = S + 1
160 T = A(I)
170 A(I) = A(I+1)
180 A(I+1) = T
185 F = 1
190 NEXT I
195 IF F = 0 THEN 210
200 NEXT J
210 REM SORT COMPLETE
```

Method three has suggested that comparisons should be limited to the out of order elements. Consider the analogy of hand sorting an index card file. The unsorted cards are placed in a pile; the first card is placed in the drawer. The second card is inserted in the drawer, either behind the first card or in front of it, as required, to maintain the proper sequence. The next card is checked against the last card in the drawer. If it is larger than that card, it is placed after it. If not, it is checked against the next card toward the front. If each card is placed in the drawer by finding its proper location and then inserting it, the number of comparisons should be minimal.

The programming steps necessary to implement this method require the concept of adding an element to the list.

```
110 FOR J = 2 TO N
120 REM INSERT THE Jth ELEMENT INTO
      THE SET 1 TO J-1
200 NEXT J
```

At the completion of the FOR-NEXT loop involving J, each element of the list is inserted into the growing list until all elements are in the list and in order. The insertion can be accomplished by using the exchange technique developed above, except the order is from back to front. The method of insertion involves using another subscript variable I, to sift back up the list, comparing the Ith element and (I – 1)st element, swapping the new Jth element until its proper place is found.

```
110 FOR J= 2 TO N
120 I = J
130 C = C + 1
140 IF A(I-1) ⩽ A(I) THEN 210
150 S = S + 1
160 T = A(I)
170 A(I) = A(I-1)
180 A(I-1) = T
190 I = I - 1
200 IF I > 1 THEN 130
210 NEXT J
```

While the variable I could be controlled with a FOR-NEXT loop, it becomes clearer to code the activity on I directly.

An improvement is introduced involving the analogy that the card is not inserted until its proper place is found. This can be accomplished by first placing the Jth element in T, then moving A(I – 1) to A(I) instead of swapping. When the proper place is found, T is moved to A(I). This change involves lines 125, 140, 160, 170, 180, 210, and 220.

```
110 FOR J= 2 TO N
120 I = J
125 T = A(I)
130 C = C + 1
140 IF A(I) ⩽ T THEN 210
150 S = S + 1
180 A(I) = A(I-1)
190 I = I - 1
200 IF I > 1 THEN 130
210 A(I) = T
220 NEXT J
```

Notice that the count for the number of swaps S is now distorted when compared to the previous methods; however, since this still moves elements only one location closer each swap, the number of swaps will not change from the above methods.

Predicting the number of compares is no longer a straight calculation. If the original list is in order, this method will make one pass through the list and accumulate N – 1 compares. The maximum number of compares and swaps will occur when each element added to the list must sift back to the beginning of the list. This occurs when the list is in reverse order and the number of compares will be 1 + 2 + 3 + ... + (N – 1). This is (N – 1)N/2, the same as for method three.

An example of method four, using the same elements as in method one follows.

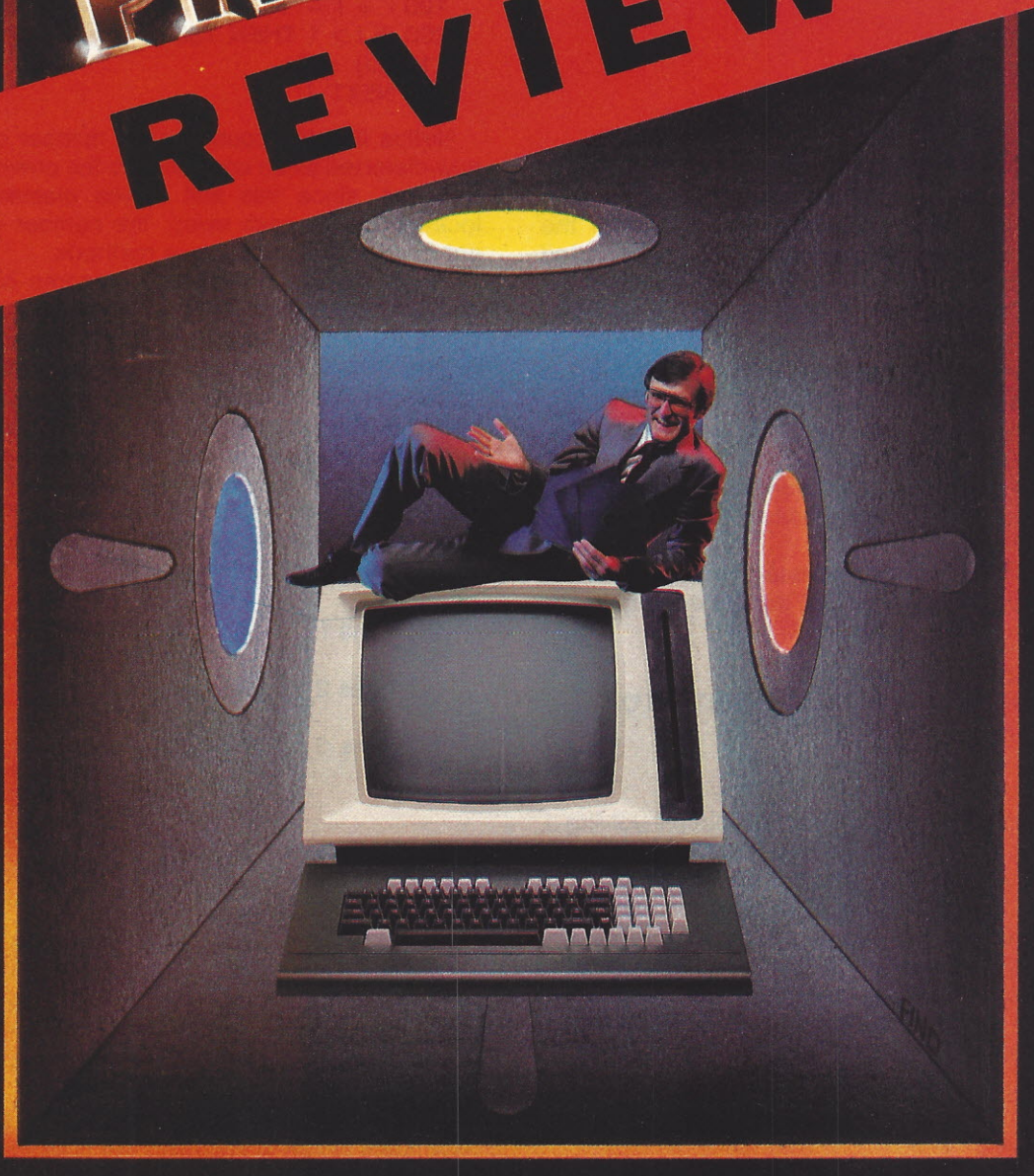
```
Pass 1    16   30
               ^    ^
Pass 2    16   30   86
                    ^    ^
Pass 3    16   30   86   10
                         ^    ^
                    10   86
               ^    ^
               10   30
          ^    ^
          10   16
Pass 4    10   16   30   86   56
                         ^    ^
                    56   86
               ^    ^
Final     10   16   30   56   86
```

Up to this point, all modifications and improvements have been aimed at reducing the number of compares. The number of swaps has remained unchanged. Method four has reduced the effort of the swap, but the number of positions an element moves remains the same. This is a result of side-by-side exchanges. The next set of improvements should involve the number of exchanges. Note the following example.

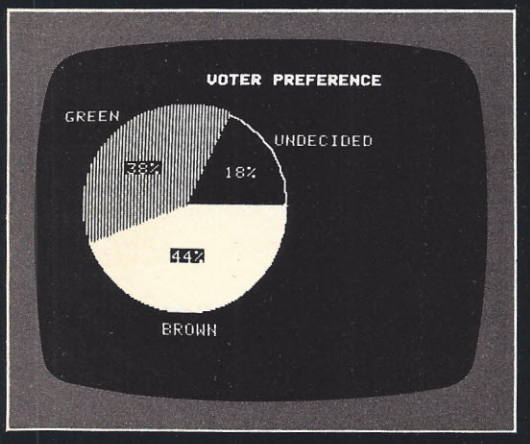
34 53 73 33 31 11 56 16 30 86 45 64 10

Continued on page 146

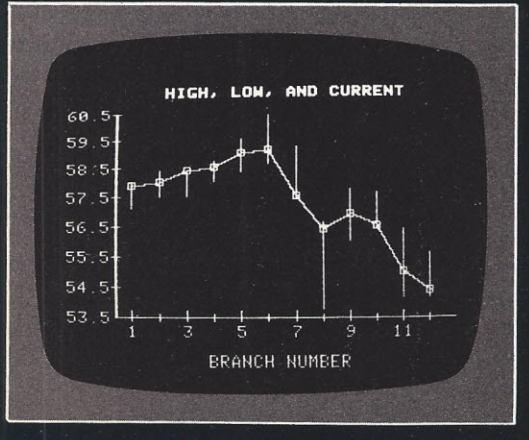
EXCLUSIVE PRODUCT REVIEW



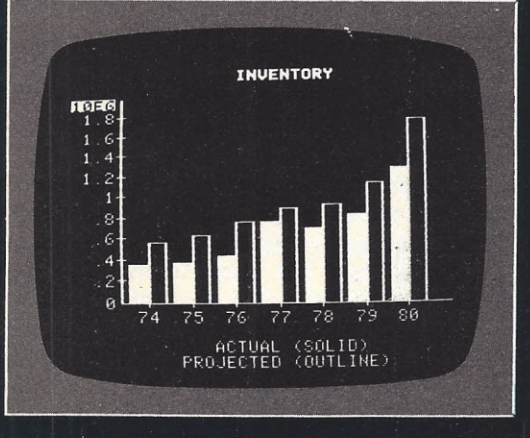
Major Additions To VisiCalc Revealed



Pie chart graph



High-low chart with closing prices



Comparative bar chart

by Carl Heintz

The makers of microcomputers have been promising for several years that their products would revolutionize the world of business. So far, this has been largely stymied by the lack of effective software. Personal Software, Sunnyvale, CA has taken giant steps forward in allowing the Apple Microcomputer to become an indispensable business tool.

Recently, the company introduced an impressive array of software products that promise to revolutionize the way business managers look at microcomputers. The products include features never before available and others possible almost exclusively on the most sophisticated mainframe installations.

Most business software is addressed towards the accounting or word processing markets. The program for data base manager, general ledger, accounts payable or accounts receivable was designed to emulate the results of programs written for much larger mainframe computers. The micro became a cost-effective replacement for a larger machine. Word processing programs, on the other hand, brought the power of the micro to the office machine level, replacing older word processors (such as the IBM MTST) with a more versatile machine at a much more cost effective price.

The Personal Software approach is radically different from most other software vendors. The company realized that to be fully utilized, the microcomputer will become an integral part in the management information processing network of the business. Due to its unique value/cost relationship, it can be effectively deployed as a businessman's personal tool to achieve new levels of productivity. The busy executive should be able to utilize his micro in the same fashion as his dictation machine, his calculator and the other tools of his trade—to efficiently achieve what would otherwise be impossible.

What areas are of key importance to the businessman, and how can products from Personal Software meet these ends? The company looked upon the following needs and satisfied them.

Application	*Product*
1. Preparation of numerical analyses such as cash flows, budgets and projections, with the ability to do "what if" calculations	VisiCalc
2. Statistical analysis of data, including analysis of trend figures, regression analysis, forecasting	VisiTrend
3. Preparation of graphs and charts from statistical data, both for presentation on the CRT and in printed format	VisiPlot

4. Communications with other computers, timesharing or remote installations, mainframe computers — VisiTerm
5. Keep files of information without setting up complex data bases—have both spontaneous and structured input and recall data by numerous keys and formats — VisiDex

These software packages are all integrated and can be interconnected. As a group, they form the most impressive set of business software on the market. The programs can turn the Apple into a serious business machine, which can significantly increase the quality of a businessman's work.

VisiCalc

By far, one of the most popular microcomputer programs ever written, VisiCalc was one of the first to allow a user to construct an "electronic worksheet." It was born out of the observation that many problems are commonly solved with a calculator, pencil and a sheet of paper. The computer replaces these tools: the computer CRT becomes an electronic window which looks on a much larger electronic sheet. This sheet is organized into a number of rows and columns, the intersections of which are data points. At each point, the user can enter an alpha/numeric title, a number or a formula to be calculated. The computer can be instructed on how to format the appearance of each entry, row or column.

The true power of VisiCalc is that the computer can use the same format and formulas to handle many reiterations. This allows a user to enter one set of data, compute and format it, and then change elements at will to see, before his eyes, how the changes affect other parts of the analysis.

Imagine that a manager wants to prepare a sales projection. Spending a little time at the computer, he enters a format for the sales forecast, which depends upon the unit sales of his three best products, the interest rates, the number of salesmen he has, and the prior month's sales as a function of these variables and enter that formula into the computer. Now, to make things more reliable, he will weigh his calculation to reflect the fact that sales are heavier in the fall and winter seasons. Finally, he will enter all necessary data to perform the calculation.

The computer will produce an analysis for him in far less time than he could have computed it manually. The analysis will show sales for each month by product line for the next 18 months. Taking the analysis to his supervisor, he probably will be given 101 changes in data to make. In the good old days, the sales manager would be looking at some long nights and weekends at the office to complete the analysis. With VisiCalc, he will be able to make the changes and return the analysis to his boss that afternoon. Speaking from first-hand experience, VisiCalc has paid for itself in its first application.

VisiCalc has been around for a few years, and its acceptance has been overwhelmingly positive. What the company has done recently is to expand the original product with enhancements that will greatly increase its versatility and make it easier to use. The new features include full implementation of a data interchange format, which allows data files generated by VisiCalc to be accessed and used by other programs (such as VisiPlot and VisiTerm). Additionally, 17 new commands have been added, which make the setup of the worksheet much easier.

The enhancements include the addition of Boolean functions such as the TRUE, FALSE, NOT,OR,IF and mathematical functions for greater than (>), less than (<), greater than or equal to (≥), less than or equal to (≤), and not equal (<>). The capacity of VisiCalc for a 48K Apple remains at 254 rows and 63 columns maximum.

VisiTrend

As business becomes more complex and sophisticated, the need to analyze business data using statistical methods becomes increasingly critical. The problem has always been that to use statistical methods, a manager had to be proficient in higher mathematics, have a lot of scratch paper, a hand full of sharp pencils and at least two or three hours of time to do mundane calculations. So much for statistical business analysis. That is, until the advent of personal computers. Even with computers, however, the software has always been less than satisfactory. Unless the user was familiar with statistical methods and the intricacies of programming, the chances of a successful implementation were slight. Further hampering the whole approach towards statistical methods was the horrendous job of entering all the data time after time.

The VisiTrend program should solve many of the problems with implementing statistical analysis techniques for business. A business manager can prepare the following analyses:

- multiple linear regression
- lead/lag analysis
- generate fitted curves
- moving averages
- percent change analyses
- perform transformations on data

series

- compute mean, min, max
- create "smoothed" data
- compute standard deviation
- do trendline analysis

The software has provisions that allow the user to generate coefficients of regressions, the T statistic, R bar squared analysis, the F statistic and the Durbin Watson statistic on any data series entered. Suddenly, the manager who learned all those fancy statistical methods in business school will be able to utilize them in the real world.

The software allows the user to have up to 16 separate data series under analysis. With this system, the user can analyze up to 645 data points, more than enough for all but the most demanding business applications. The information generated from the input data and the data itself can be stored on disk for future use, or for use with other programs. VisiTrend contains a set of utilities that enable the user to file data and results using the Data Interchange Format or the regular Apple file structure.

Continued on page 148

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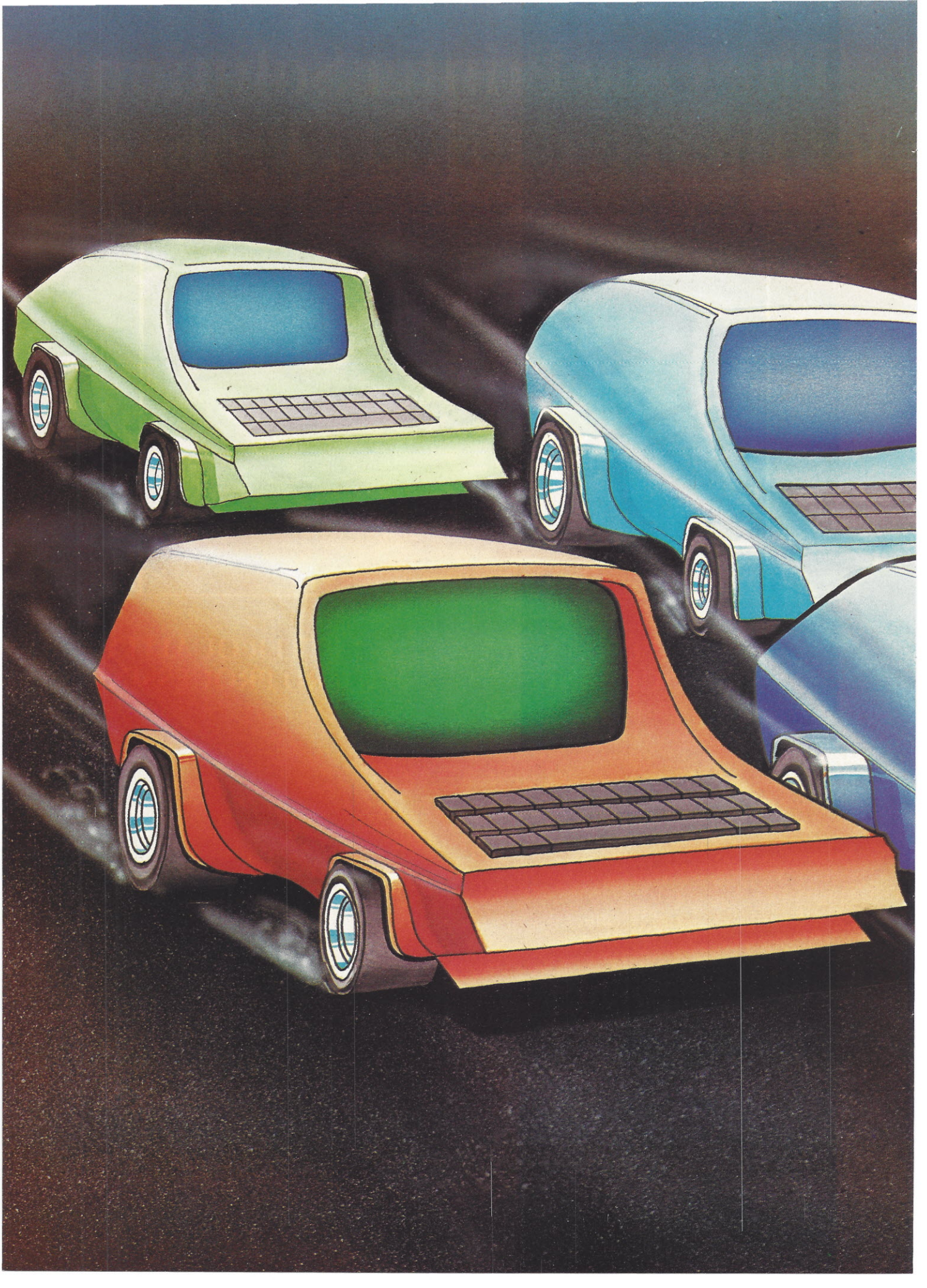

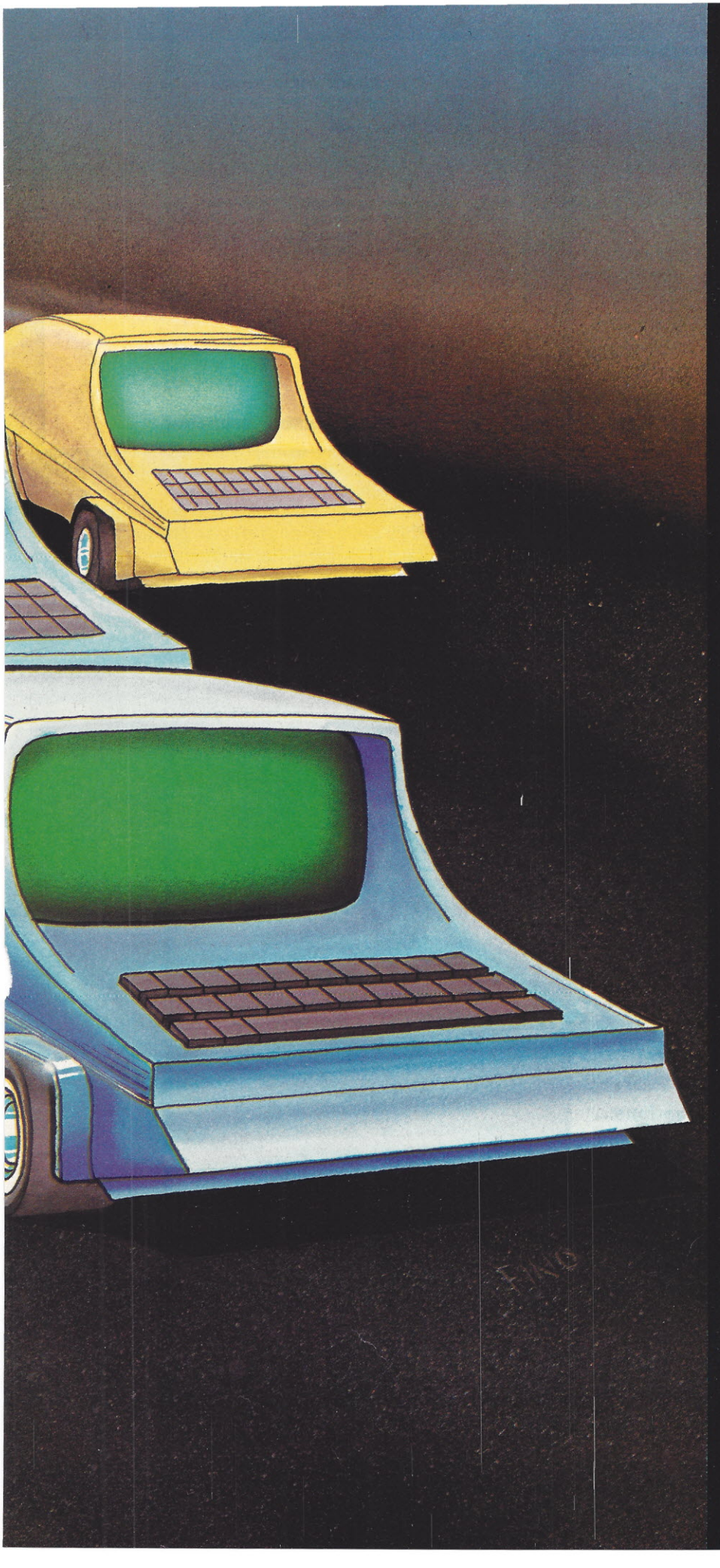

Report Card: Benchmark

by Tom Fox

Benchmark! A strangely emotion-charged word in a business dominated by the cool, logical thought processes of analytically-minded computers. Utter that pair of poison syllables at a computer gathering, and a hush will fall over the room. Benchmark! A real conversation-stopper.

In the computer industry, a benchmark is a comparative measurement, a competitive test. It usually has to do with speed of computer processing, but not necessarily. In its most common form, it is a software program that can be executed on a variety of different computers, with comparisons drawn as to which finishes the chore in the quickest time. Simple? In concept, yes...but in the real world, benchmarks are among the most difficult tests to administer in an even-handed manner.

To be fair, a benchmark program run on two (or several) competing processors must be the same in all cases—*exactly* the same. Otherwise, a difference in performance can be attributed to variations in the jobs the contendors are asked to do. The question now is which program to choose. A computer might be really good at, say, dividing multiple-precision numbers together—but impossibly slow at printing out the results. Another may have a super-fast printer output, but an inept algorithm for handling decimal points.

Reader REMarks

Following are reader reactions to our Prime Number Cruncher tests over the past few months.

Some smiled...

"...your piece was quite entertaining and informative...your little program is quite a respectable test..." (Sunnyvale, CA)

"...an interesting exercise that provoked a few days' worth of people running the program on various machines in their off hours..." (San Diego, CA)

"...that was astounding...hope you might come up with a few other tests of one kind or another..." (Princeton, BC, Canada)

"...this system is used for commercial applications, but I wanted to see how a mainframe stands against micros..." (Sacramento, CA)

...some frowned...

"...one benchmark doesn't really tell much of the story...the Prime Number Cruncher was dismal..." (Columbia, MD)

"...the 'number cruncher' may be more of a test of terminal output and baud rate..." (Albuquerque, NM)

"...you have been guilty of comparing apples and oranges...any comparison that lumps interpreted 8080 Basics into the same listing with DEC's compiled Basic loses credibility too quickly for words...one can quote benchmarks like quoting isolated passages from the Bible, and 'prove' as much..." (Houston, TX)

"...I suggest the algorithm used in the comparison was quite poor, say about 2,400 times too long..." (Atlanta, GA)

"...one benchmark doesn't really mean much by itself...but it is a fun way to make comparisons... your results don't match mine at all...you should have your unit checked...this test of yours doesn't really prove anything, but it was a lot of fun..." (Rochester, NY)

...and some offered practical observations...

"...to my surprise, the compiled CBasic program did much worse than the Microsoft version..." (Waterloo, IA)

"...the result produced by lines 180 and 190 can more efficiently be obtained by the single statement 180 IF L < 2 THEN 230..." (Sunnyvale, CA)

"...the greatest increase came with the reversal of statements 190 and 200..." (Shelton, WA)

"...removing excess spaces will give about 2% increase in speed...removing LET will give about 0.5% increase...removing REM does not affect speed if they are in the first lines...DEFINT will yield about 12% improvement...line 200 is simply not required!" (Odessa, TX)

```
100 REM    INTERFACE AGE's benchmark program to
110 REM    'discover' the first 1000 prime numbers
120 REM
130 PRINT "Starting:"
140 FOR N = 1 TO 1000
150  FOR K = 2 TO 500
160   LET M = N/K
170   LET L = INT(M)
180   IF L = 0 THEN 230
190   IF L = 1 THEN 220
200   IF M ) L THEN 220
210   IF M = L THEN 240
220  NEXT K
230  PRINT N;
240 NEXT N
250 PRINT CHR$(7)
260 PRINT "Finished."
270 END
```

Prime number cruncher

What's a good test for comparing the number-dividing abilities of these machines?

One of the most oft-heard complaints about benchmarking is that a clever engineer or programmer can always devise a task that his or her favorite computer is sure to perform faster than any other. Computers are richly complex devices; there is ample opportunity to stack the deck in favor of one over its rivals.

Here's another problem: the tasks chosen by the salesperson to demonstrate a computer's performance may have little at all to do with *your* ultimate needs. A computer at its best with mathematical operations may be a poor choice if your problem is to catalog a million volumes in a public library.

But the speed of a computer is one of its most important operating parameters. There must be *some* reliable measure of this crucial quantity. How about the raw speed of the central processing unit (CPU) itself? Some run at two million cycles per second; some at four. Some can handle but a single byte (character) at a time; some gobble two or more bytes in the same time span.

Judging performance

Can a computer's performance be measured on these terms? To an extent, yes—but this requires a depth of understanding into the workings of computers that is far beyond the abilities or levels of interest of most of us. Engineers and hobbyists talk about memory fetch cycles, disk head settling times and logic-seeking bidirectional print heads. There is no question that these things, and more, contribute to the overall performance.

But this is like judging an automobile by inspecting gear ratio, camshaft rise, and flame front turbulence. It's all talk about the *potential* for performance; not performance itself. In America, we figured out the best way to compare car performance a long time ago. You simply take them to the local drag strip and give both the same task: start *here*, and see who passes the quarter-mile post first. A crude test for sure, and subject to a host of variables that make the losers cry "foul!" time and time again—but it works.

Enter *Interface Age's* Prime Number Cruncher test. First introduced in the June 1980 issue, it has since become our standard test for computer speed.

Our readers are quite involved in this project, too. Since the test first appeared, hundreds have sent in the results of their benchmarking on a wide variety of

equipment. The accompanying tables show some of these responses. We are still encouraging readers to send in new data, so we can share it in these pages.

The grandaddy Cruncher is written in Basic. It's a simple pair of nested FOR/NEXT loops that test every number up to 1,000 to see if it's prime. (A prime number is an integer greater than one which has no exact divisors other than one and itself. The reverence with which we adhere to established mathematical concepts is highlighted by the fact that the first number "discovered" by the program (one) is not prime at all! Curiously, no one has ever noticed.) The test is a particularly inferior vehicle for computing primes. Far, far better ones exist, as many have called to our attention. But the point of the exercise is not the computation itself, but simply to give the computer some semi-meaningful busy work to perform while the stopwatch is ticking away.

Our test is simple, quite portable and—for most microcomputers—takes so long to perform that variations in timing technique and display speed have little effect on the outcome. We have seen versions of it run in Pascal, Fortran, Forth, Cobol, HPL, LISP and Z80 assembly language. This month's survey deals exclusively with the Basic version. In a later issue, we'll take up the fascinating study of comparing different language implementations on the same computer designs.

As you would expect, there is at least a rough correlation between CPU speed in cycles per second and benchmark performance. Similarly, the 16-bit micros generally have an easier time of it than the more common 8-bit units. Some CPU internal designs are particularly well suited for speed—the popular 6502 chip easily outdistances several other devices that work at higher clock rates.

Software carries the story, however. Some operating systems are inherently faster than others while worrying over the Cruncher. More dramatically, some Basic languages are far superior, even when run on the same equipment. Perhaps the most oft-noted difference is between Heath's Benton Harbor Basic and the optional Microsoft version—both are interpretive Basics, which are supposed to be inherently slower than compiled or semi-compiled Basics. That's certainly the case when comparing Microsoft's compiling Basic 5 with the more common interpretive version.

What happened to CBasic? Here is a semi-compiling language which, in every case we have seen, is *slower* than the Microsoft Basic interpreter! It's clear that speed was far from the top of the list of priorities for CBasic designers. Creating a structured, easily programmed, self-documenting programming tool came first.

Benchmarking is a powerful tool for evaluating computers; not one we should ignore just because it's hard to do right. As a tool, our test must be considered the biggest, ugliest hammer in a box full of fine precision instruments. Use it with judgment and care. For certain, don't make a buy decision based solely on how a computer holds up to this primitive chore.

Tom Fox can be reached at FoxWare Systems Corporation, 17925-G Sky Park Circle, Irvine, CA 92714, (714) 957-9332. □

Tables begin on page 80

Introducing 4 new programs from

These new programs are going to do for you just what our VisiCalc™ program has done: make your computer work harder, so you can work smarter!

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Table 1. Microcomputer benchmark results.

Runs marked * required program modification to ensure proper operation.

COMPUTER			PROCESSOR			SOFTWARE			BENCHMARK	
MANUFACTURER	MODEL	CLASS	TYPE	BITS	SPEED	OPERATING SYSTEM	LANGUAGE	TYPE	RUN BY	RUN TIME
TEI	System/48	Micro	8085	8	5.0 MHz	MAGIC 1.0	Microsoft 5.0	C	IA	178 sec
Alpha Microsystems	AM-100/T	Micro	WD-16	16	3.0 MHz	AMOS 4.3a	AlphaBasic	SC	IA	317 sec
Compu/Think	MINIMAX II	Micro	6502	8	n/a	n/a	Basic	n/a	Reader	505 sec
Alpha Microsystems	AM-100	Micro	WD-16	16	2.0 MHz	AMOS 4.4b(5)	AlphaBasic	SC	IA	562 sec
Alpha Microsystems	AM-100	Micro	WD-16	16	2.0 MHz	AMOS 4.3a	AlphaBasic	SC	IA	573 sec
Alpha Microsystems	AM-100	Micro	WD-16	16	2.0 MHz	AMOS	AlphaBasic	SC	IA	577 sec
Technico	SS-16	Micro	9900	16	3.0 MHz	DOS	Super Basic 3.0	I	IA	585 sec
TEI	System/48	Micro	8085	8	5.0 MHz	MAGIC 1.0	Microsoft 5.1 (TBasic)	I	IA	636 sec
Ohio Scientific	C4-P	Micro	6502	8	2.0 MHz	OS65D 3.2	Level I Basic	I	IA	680 sec
North Star	(w/floating point)	Micro	Z80A	8	4.0 MHz	NSDOS	North Star Basic	I	Reader	685 sec
TEI	System/48	Micro	8085	8	5.0 MHz	MAGIC 1.0	Microsoft 4.51	I	IA	691 sec
SWTP	(modified)	Micro	6800	8	1.0 MHz	n/a	TSC Basic	I	Reader	747 sec
Convergent Technologies	CT-2100	Micro	8086	16	5.0 MHz	CTOS	Microsoft Basic	I	IA	752 sec
n/a	(S-100)	Micro	Z80A	8	4.0 MHz	n/a	Microsoft Basic V5.03	I	Reader	787 sec
Radio Shack	TRS-80 model II	Micro	Z80	8	4.0 MHz	TRSDOS 1.2	Basic	I	Reader	792 sec
Radio Shack	TRS-80 model II	Micro	Z80A	8	4.0 MHz	n/a	Basic	I	Reader	823 sec
Ohio Scientific	C3	Micro	6502	8	1.0 MHz	OS65D	6-digit Basic	I	Reader	944 sec
Radio Shack	TRS-80 model II	Micro	Z80A	8	4.0 MHz	TRSDOS 1.1.2	Level III Basic	I	IA	955 sec
Apple	Apple II +	Micro	6502	8	2.0 MHz	DOS 3.2	Applesoft II Basic	I	IA	960 sec
Apple	Apple II +	Micro	6502	8	2.0 MHz	DOS 3.2	Applesoft 2	I	Reader	980 sec
Rockwell International	AIM65	Micro	6502	8	2.0 MHz	n/a	Microsoft Basic	I	IA	1001 sec
Rexon	RX30	Micro	8086	16	5.0 MHz	RECAP	Business Basic	I	IA	1020 sec
Cromemco	System 3	Micro	Z80A	8	4.0 MHz	CDOS	32K Basic	I	Reader	1074 sec
Cromemco	n/a	Micro	Z80A	8	4.0 MHz	CDOS	Extended Basic	I	Reader	1116 sec
North Star	n/a	Micro	Z80A	8	4.0 MHz	NSDOS	North Star Basic	I	Reader	1140 sec
Hewlett-Packard	HP-83A	Micro	n/a	8+	0.6 MHz	n/a	Basic	I	IA	1243 sec
n/a	n/a	Micro	8080	8	1.9 MHz	NSDOS	Microsoft Basic	I	Reader	1268 sec
Intelligent Systems Corp.	Intecolor 3651	Micro	8080	8	1.0 MHz	FCS	Extended Disk Basic	I	IA	1269 sec
Exidy	Sorcerer	Micro	Z80	8	2.0 MHz	n/a	Standard Basic	I	Reader	1285 sec
Ohio Scientific	C3	Micro	Z80	8	2.0 MHz	n/a	Microsoft Basic	I	Reader	1325 sec
Ohio Scientific	C3-C	Micro	6502	8	1.0 MHz	OS65D	Level I Basic	I	IA	1346 sec
Commodore	Pet 2001	Micro	6502	8	n/a	n/a	Microsoft Basic	I	Reader	1374 sec
Intelligent Systems Corp.	Compucolor 8051	Micro	8080	8	1.0 MHz	FCS	Basic 8001	I	IA	1375 sec
Hewlett-Packard	HP-85	Micro	n/a	8+	0.6 MHz	n/a	Basic	I	IA	1380 sec

COMPUTER			PROCESSOR			SOFTWARE			BENCHMARK	
MANUFACTURER	MODEL	CLASS	TYPE	BITS	SPEED	OPERATING SYSTEM	LANGUAGE	TYPE	RUN BY	RUN TIME
Basic/Four	600	Micro	8080	8	n/a	n/a	Basic	I	IA	1404 sec
Ohio Scientific	C1P Series 2	Micro	6502	8	1.0 MHz	PICO DOS	ROM Basic	I	IA	1431 sec
Micro Five	MicroStar I	Micro	8085	8	3.0 MHz	StarDOS	StarDOS Basic	I	IA	1438 sec
Radio Shack	TRS-80 Color	Micro	6809E	8	0.9 MHz	n/a	Basic	I	IA	1457 sec
Sinclair Research	ZX-80	Micro	Z80A	8	3.2 MHz	n/a	ZX-80 Basic	I	IA	1631 sec
Processor Technology	SOL-20	Micro	8080	8	2.0 MHz	SOLOS	Extended Cassette Basic	I	Reader	1812 sec
Heath	H89	Micro	Z80	8	2.0 MHz	HDOS	Microsoft Basic V4.7	I	Reader	1850 sec
Zilog	MCZ-1/70	Micro	Z80A	8	4.0 MHz	RIO	Zilog Basic	I	Vendor	1864 sec
Radio Shack	TRS-80 model I	Micro	Z80	8	1.8 MHz	TRSDOS	Level II Basic	I	Reader	1879 sec
Digital Group	n/a	Micro	Z80	8	2.5 MHz	DISKMON	Microworks Basic V2.10	n/a	Reader	1889 sec
Radio Shack	TRS-80 model I	Micro	Z80	8	1.8 MHz	TRSDOS	Level II Basic	I	Reader	1928 sec
Radio Shack	TRS-80 model I	Micro	Z80	8	1.8 MHz	TRSDOS 2.3	Basic	I	Reader	1939 sec
IBM	5100	Micro	n/a	16	1.9 MHz	n/a	Basic	I	Reader	1951 sec
IBM	5120	Micro	n/a	16	1.9 MHz	n/a	Basic	I	IA	1956 sec
Heath/Zenith	WH89/Z89	Micro	Z80	8	2.0 MHz	HDOS	Microsoft Basic	I	IA	2027 sec
Processor Technology	SOL-20	Micro	8080	8	2.0 MHz	NSDOS	NS Basic V5.1/8-digit	I	Reader	2217 sec
Vector	MZ	Micro	Z80	8	n/a	n/a	Micropolis Basic	I	Reader	2251 sec
Cromemco	System 3	Micro	Z80A	8	4.0 MHz	CDOS	CBasic-2	SC	Reader	2445 sec
Cromemco	Z-2	Micro	Z80A	8	4.0 MHz	CP/M	CBasic	SC	Reader	2463 sec
n/a	n/a	Micro	8080	8	1.9 MHz	NSDOS	North Star Basic	I	Reader	2473 sec
Texas Instruments	TI-99/4	Micro	9900	16	3.0 MHz	n/a	Basic	I	Reader	2479 sec
Texas Instruments	TI-99/4	Micro	9900	16	3.0 MHz	n/a	Basic	I	IA	2480 sec
Heath	H8	Micro	8080	8	2.2 MHz	n/a	Benton Harbor Basic	I	Reader	2520 sec
SuperBrain	n/a	Micro	Z80	8	n/a	n/a	CBasic	SC	Reader	3180 sec
Polymorphic	Twinsystem 88	Micro	8080A	8	1.9 MHz	DOS	Basic	I	IA	3300 sec
Processor Technology	SOL-20	Micro	8080	8	2.0 MHz	NSDOS	NS Basic V5.1/16-digit	I	Reader	3371 sec
Heath	H8	Micro	Z80A	8	2.0 MHz	HDOS 50.04	BH Basic V110.02	I	Reader	3390 sec
Heath	H89	Micro	Z80	8	2.0 MHz	HDOS	BH Basic V110.02.00	I	Reader	3550 sec
Heath	H89	Micro	Z80	8	2.0 MHz	HDOS	Extended BH Disk Basic	I	Reader	3605 sec
Heath/Zenith	WH89/Z89	Micro	Z80	8	2.0 MHz	HDOS	Benton Harbor Basic	I	IA	4211 sec
SWTP	n/a	Micro	6800	8	0.9 MHz	n/a	Percom Super Basic	I	Reader	4380 sec
n/a	n/a	Micro	8080	8	1.9 MHz	NSDOS	CBasic V1.01	SC	Reader	4620 sec
SWTP	n/a	Micro	6800	8	0.9 MHz	n/a	SWTP V2.3 8K Basic	I	Reader	4860 sec
APF	Imagination Machine	Micro	6800	8	0.9 MHz	n/a	Basic*	I	IA	7950 sec
Netronics	ELF II	Micro	1802	8	1.8 MHz	n/a	Tiny Basic*	I	Reader	26416 sec

n/a = information not available

Table 2. The big and little brothers of microcomputers show their stuff.

COMPUTER			PROCESSOR			SOFTWARE			BENCHMARK	
MANUFACTURER	MODEL	CLASS	TYPE	BITS	SPEED	OPERATING SYSTEM	LANGUAGE	TYPE	RUN BY	RUN TIME
Univac	1100/81	Mainframe	n/a	36	n/a	36R2A/53046	U Basic	n/a	Reader	3 sec
IBM	3033	Mainframe	n/a	n/a	n/a	VS2.1/ORVYL	Stanford Basic	n/a	Reader	10 sec
Prime	550	Mainframe	n/a	n/a	n/a	PRIMOS	Basic V16.4	I	Reader	63 sec
Digital Equipment	PDP-10	Mainframe	n/a	36	n/a	TOPS-10	Basic	I	IA	65 sec
Prime	500	Mainframe	n/a	n/a	n/a	n/a	Basic	n/a	Reader	96 sec
IBM	3031	Mainframe	n/a	n/a	n/a	CMS	Waterloo Basic	n/a	Reader	103 sec
IBM	System/34	Mainframe	n/a	n/a	n/a	Release 05	Basic	I	Reader	129 sec
Digital Equipment	PDP-10	Mainframe	n/a	36	n/a	n/a	Basic	C	Reader	294 sec
Hewlett-Packard	HP-3000II	Mini	74181	16	5.7 MHz	MPE III	Basic	C	Reader	10 sec
Digital Equipment Corp.	PDP-11/70	Mini	n/a	16	n/a	n/a	Basic	I	Reader	45 sec
Wang	2200VS-8E	Mini	n/a	16	n/a	n/a	Basic 2.3.1	C	Reader	89 sec
Corporate Data Sciences	HEX29	Mini	2900	16	6.0 MHz	HOST	HBasic +	I	Vendor	143 sec
Hewlett-Packard	HP-3000	Mini	n/a	16	n/a	Time Share	Basic	I	Reader	250 sec
Hewlett-Packard	HP-3000II	Mini	74181	16	5.7 MHz	MPE III	Basic	I	Reader	267 sec
Digital Equipment Corp.	PDP-11/45	Mini	n/a	16	n/a	n/a	Basic	I	Reader	330 sec
Digital Equipment Corp.	PDP-8	Mini	n/a	12	0.3 MHz	OS/8	Basic V3	I	Reader	490 sec
Data General	NOVA 3	Mini	n/a	n/a	n/a	Time Share	Basic 5.32	I	Reader	517 sec
Digital Equipment Corp.	PDP-11/20	Mini	n/a	16	n/a	n/a	Basic	I	Reader	1140 sec
Hewlett-Packard	HP-9831	Desktop	n/a	16	n/a	n/a	Basic	I	Reader	410 sec
Hewlett-Packard	HP-9845A	Desktop	n/a	16	6.0 MHz	n/a	Basic	I	Vendor	413 sec
Hewlett-Packard	HP-9845B	Desktop	n/a	16	n/a	n/a	Basic	I	Reader	450 sec
Hewlett-Packard	HP-9835A	Desktop	n/a	16	n/a	n/a	Basic	I	Reader	511 sec
Hewlett-Packard	HP-9825B	Desktop	n/a	16	5.7 MHz	n/a	Basic	I	Vendor	533 sec
Hewlett-Packard	HP-9830A	Desktop	n/a	n/a	n/a	n/a	Basic	I	Reader	3108 sec
Radio Shack	TRS-80 PC	Handheld	n/a	n/a	n/a	n/a	Basic	I	IA	55830 sec

n/a = information not available

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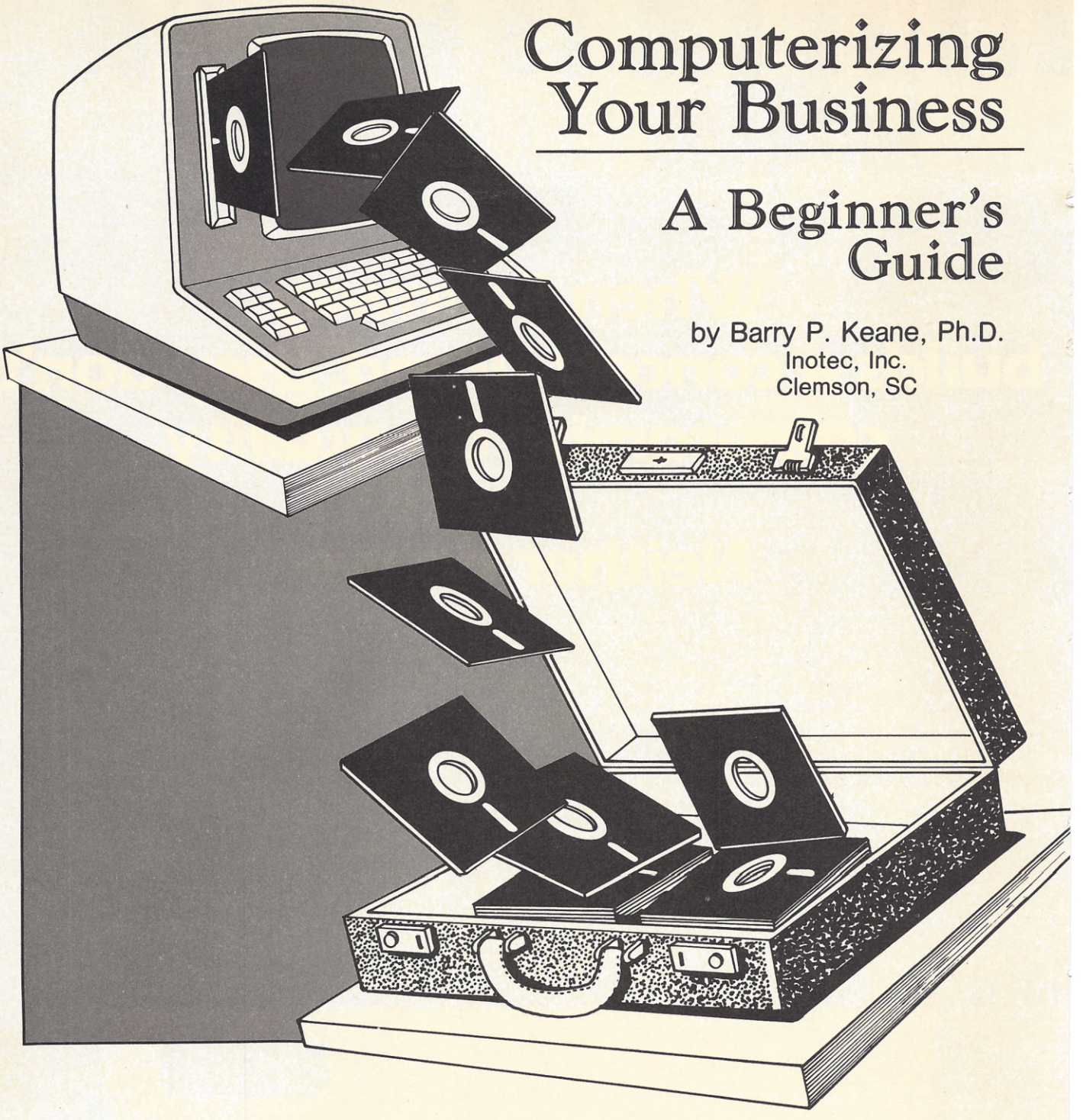
Computerizing Your Business

A Beginner's Guide

by Barry P. Keane, Ph.D.
Inotec, Inc.
Clemson, SC



An estimated half-million small businesses will purchase their first computer over the next twelve months. If you are among them and know as much about computers as you do about brain surgery, take heart. The guidelines presented here should help you to approach the problem intelligently, without making any costly mistakes.

Buying a small business computer is a lot like buying a car. To begin with, the cost is about the same. If you priced a business minicomputer a few years ago, and are expecting to have to pay $30-40,000 to computerize, you'll be pleasantly surprised at what today's microcomputers can do for a fraction of that amount. But don't expect miracles from a computer that costs $300, loads programs from an audio cassette, and comes complete with Space Adventures software. Minimal cost of a true business system—a dependable, everyday workhorse of a system—is about $8,000. Be cautious about those costing less.

A Chevrolet salesman, even a very reputable one, is not about to tell you the best car for your particular needs is a Ford or Toyota—even though this may be the case. What he *will* do is try to put you into the Chevrolet that fits you best. Computer dealers are no different. You need to do a little bit of homework before walking into the showroom. The dealer provides valuable assistance and support, but since no one knows your business and its needs better than you do, you are the one who must decide what is right for you.

A good piece of advice is to select the software first. Then, go looking for hardware to run it on. You'll be a lot less apt to wind up at a dead end than if you select

the hardware first, then try to find compatible software that adequately meets the needs of your business.

In identifying areas where a computer can help your business, look for high volume, repetitive procedures. These are good candidates for computerization. The speed, efficiency and organization of a well-designed accounts receivable package may be just the remedy for frequent tardiness in billing and collections.

Businesses such as law offices, consulting firms, contractors, and service companies often have a high volume of contracts, proposals and other time-consuming typing jobs. A good word processing package can be effective in helping these offices to run with greater efficiency. Mailing list software can be a tremendous benefit to the promotional efforts of companies who rely on direct mail advertising.

Alleviate tedium

Payroll is another task that is repetitive, time consuming and boring. A payroll package can print checks, calculate state and federal taxes and other deductions, automatically post to the general ledger and even generate W-2s and 941s. If you find yourself overwhelmed with keeping track of inventories, an inventory control package may provide the solution.

If you have two or more employees spending most of their time doing paperwork, a computer can almost certainly be cost effective for your operation. But a computer system should not be thought of as a replacement for staff. Nor should its acquisition depend exclusively on identifying positions that it will eliminate. Its real value may lie in releasing some of those individuals to work at something more productive. Likewise, installing a computer should not change what you do—it should help you to continue to do exactly those same things, but more efficiently.

Besides helping with time-consuming paperwork bottlenecks, a computer system can help you with financial analysis and planning by putting key financial data at your fingertips. The benefits are perhaps less tangible, but may actually be of even greater significance. Financial reporting and analysis, cash flow management, budget preparation, sales and production forecasting and overhead calculations are all services that a computer can provide to give you an inside track in a rapidly changing economy.

Just as the computer is not a replacement for your staff, it is not a replacement for your accountant. But it can certainly help him in analyzing your business and its needs. Your accountant can be a great help to you in selecting the proper software system for your business.

Once you have identified areas where a computer can be of help, you need to compile accurate, quantitative specifications for each potential application. Properly defining your requirements is a difficult and time-consuming task, but nonetheless a necessary one and one that will pay off in the long run.

In outlining your specifications, take into consideration your projected growth over the next 3-5 years. You won't want to outgrow the system before then. It would also be a good idea to look beyond five years and to find out how difficult transition to a larger system will be when the time comes.

For a rapidly growing enterprise, it may be advisable to purchase a computer that is a part of a compatible family of systems. Although the initial cost may be

Some Popular General Ledger Packages

(All packages shown are run under the CP/M operating system and have source code available.)

COMPANY	HARDWARE REQUIREMENTS	LANGUAGE REQUIREMENTS	REPORTS GENERATED	INTERFACING PACKAGES
Peachtree Software 3 Corporate Sq., Suite 700 Atlanta, GA 30329	8080, Z80, or 8085 132 column printer video unit dual disks (.5M-byte) 48K bytes RAM	Microsoft Basic	trial balance transaction register balance sheet income statement comparative financial statements departmental income statement	accounts receivable accounts payable payroll
Structured Systems Group 5204 Claremont Oakland, CA 94618	8080 or Z80 CPU 132 column printer 80 by 24 video unit dual disks 52K bytes RAM	none required	trial balance balance sheet accounts distribution transactions supporting schedules income statement profit center reporting	accounts receivable accounts payable payroll
Graham-Dorian Software P.O. Box 16355 Fort Worth, TX 76133	Available for most most CP/M systems. Hardware requirements vary	CBasic-2	chart of accounts transaction register balance sheet trial balance financial statements comparative financial statements departmental financial statements	accounts receivable accounts payable payroll inventory job cost order entry/invoicing
Omikron 1127 Hearst St. Berkeley, CA 94702	8080 or Z80 CPU 80 by 24 video unit 132 column printer	Microsoft Basic	chart of accounts transaction register trial balance balance sheet income statement departmental income statement comparative financial statements	accounts receivable accounts payable payroll

higher, the lower cost of moving up to a larger system can make the long-range cost lower.

In acquiring software that meets your specifications, you may 1) buy a standard application package and use it without modification, 2) buy a standard package and have some minor customization done by the dealer or a consultant to make it better suited to your requirements, or 3) hire someone to write a custom software package designed specifically for your application.

Minor corrections easy

Option (1) is the least expensive. The better business application programs are generally quite flexible and will work well for a lot of businesses without any modification at all. Minor modifications, such as changing report formats or adding the company to name printouts, are relatively easy to make and will not add a lot to the overall system cost. Be sure that the supplier provides the source code (the text of the program). A programmer needs this before he can make any modification.

Completely custom software is not practical for most businesses. The cost of implementing a completely custom integrated business package would typically be greater than the cost of the system hardware. Another problem with custom software systems is that bugs often go undetected long after the initial installation. As much as 50% of the lifetime cost can be spent in correcting these errors. Despite its drawbacks, this may be the only alternative for business with unique requirements. It can be cost effective, though, if the benefits are such that the system will pay for itself in a reasonable length of time and if the job is done properly.

If you require custom programming, be very careful about selecting a programmer. An experienced programmer will charge more, but you will be better off in the long run. You'll have a professionally designed and supported package, delivered on time and documented. Talk to some of his former clients and take a look at what was produced. Does it perform the way it was supposed to? Does he continue to support it? Is it properly documented?

In contracting for custom software, be specific about deliverables and payments. As with any contract, it is vital that each party understand what is expected of him. If the job is a large one, break it up, identifying several small deliverables. Spell out how each deliverable is to be demonstrated and what payment will be made. Paying an initial good faith retainer of up to 25% is reasonable, but no further payments should be made without demonstrable progress.

Experiment first

It will be helpful to make up some sample reports so there will be no doubt about the content or format. Specify what the user input and operating requirements are. Try to anticipate things that can go wrong, for example, if a power failure occurs or if erroneous data is entered. How does the system recover?

The next task is finding software that meets your specifications. Sifting through the hordes of available software is no small undertaking. Ads in microcomputer magazines are a good starting point. In general, the more highly visible products are the better packages.

Some characteristics of four popular general ledger packages are outlined in the table. All four are very

good and have been in use for years. They should be virtually error-free at this point.

All four use the CP/M operating system. A computer's operating system is a special piece of software that, among other things, interfaces general purpose application programs to a specific set of hardware resources. CP/M has become a defacto standard of the microcomputer industry. As a result, just about every type of program imaginable is available for systems using it.

Selection of a piece of software dictates to some degree what the hardware will look like. Printer, CPU type, system memory and disk space are important considerations. The central processing unit (CPU) is the heart of the system. CP/M is designed for use with either 8080 or Z80 CPUs, components developed by Intel and Zilog, respectively. You should not be concerned about the CPU, other than to be sure that it is compatible with the operating system and software.

A picture is worth a thousand words; so is a sample printout.

System memory, sometimes called RAM (random access memory), is specified in bytes. One byte stores one text character. One kilobyte (1K bytes) will store about a thousand characters, 48K bytes will store about a thousand characters, etc. Disk capacity is also specified in bytes, kilobytes, or megabytes, 1M bytes being roughly equivalent to a million characters of storage.

Disks are used to store programs and data. The most common type of disk for small business systems is the flexible or floppy disk. There are two standard sizes: 5¼ and 8 in. Business systems should have two or more disks. Although it's possible to operate some systems with a single disk unit, making backup copies becomes a real headache, because it is necessary to change disks several times during backup procedure.

Three of the four G/L packages in the table require some type of language support. Applications programs are written in a computer language that must be interpreted and converted to a set of operations that can be understood and executed by the CPU. The most common lanugages in business applications are Basic and Cobol. You must have the right one for the given application. The appropriate languge support can usually be purchased along with the application package.

Each package in the table produces about the same set of standard accounting reports. A picture is worth a thousand words; so is a sample printout. Software houses will usually provide them free of charge. Looking at the sample reports, you begin to get a feel for what the system can do for you.

A complete integrated business system can be configured using one of these packages and some combination of interfacing packages—accounts receivables, payroll, etc. An integrated business system is

one in which each of the component parts is aware of what the other parts are doing. Some systems function as independent modules where the general ledger doesn't know what the accounts receivable is doing unless the user actually takes numbers from the A/R and feeds them, correctly or incorrectly, to the G/L. These programs are usually very inexpensive, and you get what you pay for.

Once you feel you have a package that meets your requirements, get hold of a system user's manual. They usually cost about $30. The manual should tell you just about everything you want to know about the system's operation. Take your time and read it over thoroughly, making sure you understand how the package fits in with the operation of your business.

"Friendly" is a plus

There are a few important characteristics to look for in a mature, professional piece of business software. First, it should be "friendly." Using it should be a pleasurable experience. If the system is fun to use, you and your employees will find additional uses for it, and it will be of greater value to your business. If it is frustrating or aggravating to use, people will avoid it like the plague. This kind of assessment is difficult to make without having day-to-day experience using the system, so you really need to talk to someone who is presently using it.

Input commands should be logical, flexible, and easy to remember. If you do forget a command, the program should have optional menus to help you get back on track. There should be an automatic backup facility, a means of protecting yourself from loss of data due to a hardware failure. It should not be optional, but should be performed at specific times by the system without any special action required of the operator.

The documentation should be written so that a non-technical person can understand the system, the facilities provided, when, where and how to use them.

It's downhill from here. Having found some software that seems appropriate for your business needs, contact the company that produces the software and get the name of their nearest representative. Check out the other dealers in your area also. They may have equivalent packages that they prefer and will support better. It's all right to let yourself be converted to another system, but only if you don't have to make any major compromises with regard to how the software serves your needs.

Check the dealers carefully. The single most important piece of advice to offer a novice computer shopper is talk to present users. Present users are the most valuable source of information about the dealer, his reputation, his product and his service. Inquire about all these things; talk to several of his customers. It won't take long to compile an accurate overall picture.

The dealer can be a very valuable resource for you. He can help you with installing the system, making minor modifications, training your staff, finding special applications software, and maintaining and updating your system.

Material for this article was taken from The Business Software Selection Kit, *which can be purchased for $39.95 from Inotec, Inc., P.O. Box 1587, MS 111, Clemson, SC 29631.* □

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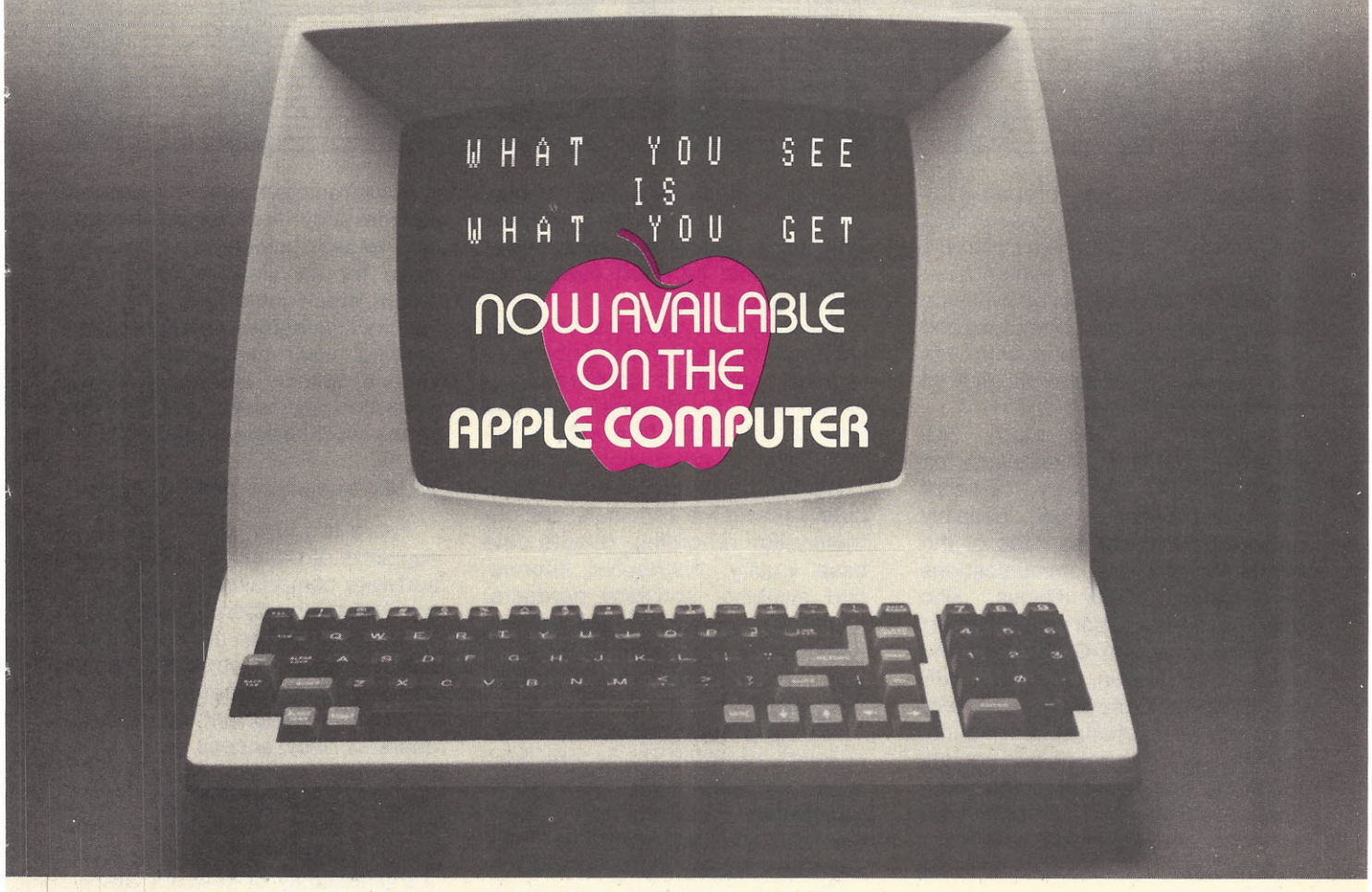

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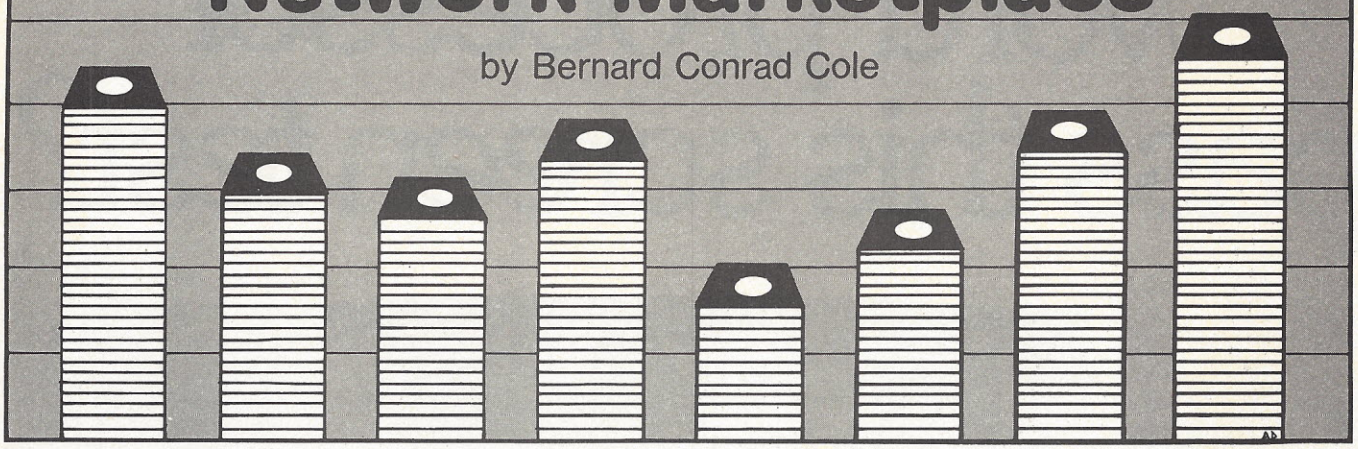
The Emerging Network Marketplace

by Bernard Conrad Cole



If a detailed study prepared by the Center for Futures Research at the University of Southern California is any indication, a vast supermarket of network services will be available to users of personal computers and remote terminals. Along with this will come a series of sophisticated information stations.

According to the study *The Emerging Network Marketplace,* an important new industry, Network Information Services (NIS), is rapidly emerging from the marriage of the computer and telecommunications technologies. Bert Nanus, who coauthored the report with Herbert S. Dordick, Helen G. Bradley and Thomas H. Martin, says that NIS could virtually transform not only the way we exchange information, but the very nature of our society itself. He points out that the widespread introduction of numerous services could provide a number of benefits.

Low cost through sharing

There are several economic advantages. First, the fact that such services provide the opportunity for sharing a portion of a more comprehensive system may result in considerable cost savings. For example, the use of a portion of a fully utilized, geographically deployed, high capacity communications system may offer more capability than the design and operation of a dedicated lower capacity network, and should be less expensive.

Second, the availability of complex general purpose software packages, with cost distributed over many users, should be more flexible, as well as economical.

Typically, the systems have the ability to handle large numbers of remote users in a conversational mode (such as Micronet and The Source) and adapt to a wide range and form of information services. They may also include raw computing power via terminals, remote transaction recording, remote data base inquiry, distributed information systems, software products, facilities management, communications media and terminal services and reproduction and facsimile transmission.

Among the applications services currently provided are general business services such as payroll generation and budgeting models; scientific and engineering services, such as statistical routines; specialty applications, including such things as seismic data processing and programs to operate numerically controlled machine tools; accounting services for banks; and utility services, including language compilers, sorting arrangements, data base management, information retrieval software and library routines.

In addition, econometric consulting services, financial and economic consulting services, financial and economic remote computing services, data base subscription services and financial inquiry services are offered.

Some remote transaction services include securities trading, hospital insurance, banking, specialized tasks for car dealers, retail drug stores, stock quotations, data bases for stock investors, credit card processing, cash management, reservations, check authorization and collection, and census and local data bases for interactive research.

Rapid transfer—high density

There are now more than 4,000 suppliers of computer services and software comprising the NIS industry. And the number is still growing. The most common markets include business, government and consumer services, and general applications.

What is important to personal users is that access is provided to scarce or infrequently needed resources that an individual cannot justify owning. It also must provide rapid mobility of information among the community of network users.

What is new about this medium of communications, says Nanus, is that it provides extremely rapid transfer of symbols and images at much higher density than human conversation, much greater speed than the postal system, and much greater selectivity than television and other mass media.

It can connect the needs and resources of users to the capabilities and services of producers and facilitate transactions. Products and services can be advertised; buyers and sellers can be located; order,

billing and delivery can be facilitated; and all manner of transactions can be consumated, including wholesale, retail, brokering and mass distribution.

The most important segment of the marketplace to the personal user—and to the entrepreneur in the long run—is consumer network services, delivered to residences over networks via terminals available in residences.

The 100 million homes expected in the 1990s constitute the most potentially profitable marketplace. Some 36 residence-based consumer network services have been identified, says Nanus. According to the report, the most lucrative household network services by the mid-1990s are likely to be those offering banking, entertainment, security services, general information, a goods and services directory and electronic games.

New social and cultural attitudes are emerging, says Nanus, which result in a mixed feeling toward the network marketplace.

On the one hand, the marketplace is non-polluting and energy efficient. It also offers opportunities for those with new skills, in keeping with a trend toward continuing education and career flexibility and mobility. It can expand group interaction and create social networks bound by areas of interest rather than geography. Indeed, an accessible network marketplace could create a climate in which diversity and pluralism can flourish.

On the other hand, there are negative attitudes that may hinder the evolution process. Computers, terminals, recorded voices and computer-simulated speech are viewed as depersonalizing by many and may certainly create fear and resentment. The adoption of many services, such as remote purchasing and banking may be delayed because of a widespread perception of this effect.

Privacy endangered?

Perhaps more important, according to the USC report, will be a continuing concern for the maintenance of personal and organizational privacy. Any significant breakdown in privacy safeguards, says Nanus, will result in an increased fear of technology and of one's inability to control one's own environment. And there is the fear that increasing activities on the network will lead to decreased personal interaction and isolation from society.

Another factor that may slow the adoption is inflation, which is likely to continue unabated for the next two decades. The severe tightening of the money supply will reduce the capital available to start new industries, especially if there are more attractive opportunities in other areas.

Demographics is also creating a somewhat confused environment. On balance, says Nanus, it appears that conditions overall are favorable. Single person households, smaller families, and a greater economic independence for women would appear to create the need for a more efficient use of time; hence, the use of the network for such time consuming or tedious duties as banking, shopping and general information seeking.

And despite the continuing high rate of inflation, higher personal income may provide more disposable income, suggesting a shift toward more appropriate and efficient methods of carrying out routine tasks, as well as the use of networks for intellectual and recreational activities.

Finally, despite some evidence of a "back to the city" movement, the long term trend seems to be an increasing shift of the population from the suburbs to rural areas, even at a time when energy and transportation costs are increasing. Remote transactions via the network will appear increasingly attractive as energy costs increase.

Balancing the negative trends is a certain technological inevitability. The consumer network portion, for example, is not limited by technology. Both terminals (the telephone and television receiver in most homes and the personal computers in a growing number) are available to more than 98% of all U.S. homes.

Accelerating progress in large scale integration is likely to result in the development of increasingly more intelligent terminals and personal computers.

Very large scale integration technology will also impact software costs, which account for almost 85% of the total cost, as hardware and software continue to mesh. According to the report, add on terminal components with plug-in

capability to enhance the flexibility of a terminal or computer will be offered. In addition, communications support or software compatibility that will permit network access by users to a wide range of data bases will be generated, in response to market pressures rather than any extensive national effort to devise a universal network access language.

For some time to come, the casual user will have to cope with an unfriendly environment. Only after the number of such users is large enough to form an attractive market will the information providers or equipment manufacturers consider providing software support specific to their needs. This is likely to begin in the form of either disk-based programs, and later as plug-in firmware.

Of the three scenarios in the study—market, technology or policy driven—it is the first that will have the most beneficial effect on the average consumer. The profit to be derived from doing business in the network marketplace will become increasingly evident as the cost of labor increases and inflation continues to require two sources of income.

With over 100 million homes in which to market, major merchandizers, airline companies, banks, insurance companies and food retailers will become very much aware of the potential of the network marketplace for selling their wares.

It is already becoming obvious that the cost of person-to-person transactions, either at the bank or across a sales counter, is growing much more rapidly than other sectors of the economy. This is due, in part, to the high and rising cost of labor, but also to the complexity of the services being offered.

More attractive benefits

The benefits for those using an intelligent terminal to conduct a transaction instead of a clerk or salesperson could be substantial. By the mid-90s, according to the report, these benefits will become attractive enough for the sellers to begin to actively seek buyers on the network.

However, for the marketplace to be valuable, many buyers and sellers must have access to it. It will be important for the sellers to provide access to a large number of potential buyers. If market-driven forces remain dominant, according to Nanus, the industry could develop along several possible paths.

Broadband cable television systems will have reached about 60% of all U.S. TV households. This will represent over 50 million households. The advantages of products and services sold via images on television will eventually be seen to outweigh even the lower costs of catalogs and possibly even throwaway newspapers. This will be especially true of the viewer who can make a purchase decision and take action without leaving home.

Feedback is important

Major merchandisers will seek to purchase time on cable systems in the more heavily saturated markets for the presentation of video catalogs, but on condition that the cable system provides some means of feedback.

While telephone feedback directly to the seller is likely to be used initially, this will not be as cost effective to the seller as feedback via the cable to a minicomputer either at the cable head end or at the seller's warehouse. Feedback via broadband cable, utilizing digital techniques and either time or frequency division multiplexing will be a great deal less expensive than the telephone.

If the sellers do not want to deal with the cable industry, it will be necessary for sellers to make use of the telephone system. By demonstrating the increased potential for utilization of the telephone for buying and selling, sellers will create a significant demand on the telephone companies for increased local digital services at lower costs.

If, at the same time sellers encourage cable television companies to enter the local distribution services business, American Telephone and Telegraph will be encouraged to accelerate the conversion of its local loop to a digital system and to provide more intelligent telephones via its Common Channel Interoffice Signalling System (CCIS). In addition, under pressure from major consumer merchandising organizations, AT&T's ACS will be accelerated.

Several major merchandisers and possibly the airline industry will offer their own network services. This can be done easily by sellers paying the consumer's communications costs outright through the use of

nationwide WATS services. The cost of these services will continue to fall as smaller satellite earth stations become more widespread and there is further bypassing of the local telephone loop, or at least significant reductions in the final mile cost, such as those provided by Xerox's XTEN.

A seller could, in effect, create a network by providing multiple services to those wishing the communications for which the seller pays. The seller would also provide services, which would require the continued marketing of useful information or instructions for the operation of the appliance (terminal or computer) sold to the household.

Electronic message services to the home will emerge as a significantly attractive market to encourage challenges to the U.S. postal service, which, in any case, is making some progress towards electronic mail.

Entertainment services via a network, perhaps incorporating the video-disk and/or cable, are network services that could be provided through the growing distribution of digital networks that may be less than public but somewhat more than a private seller's network.

Small earth stations

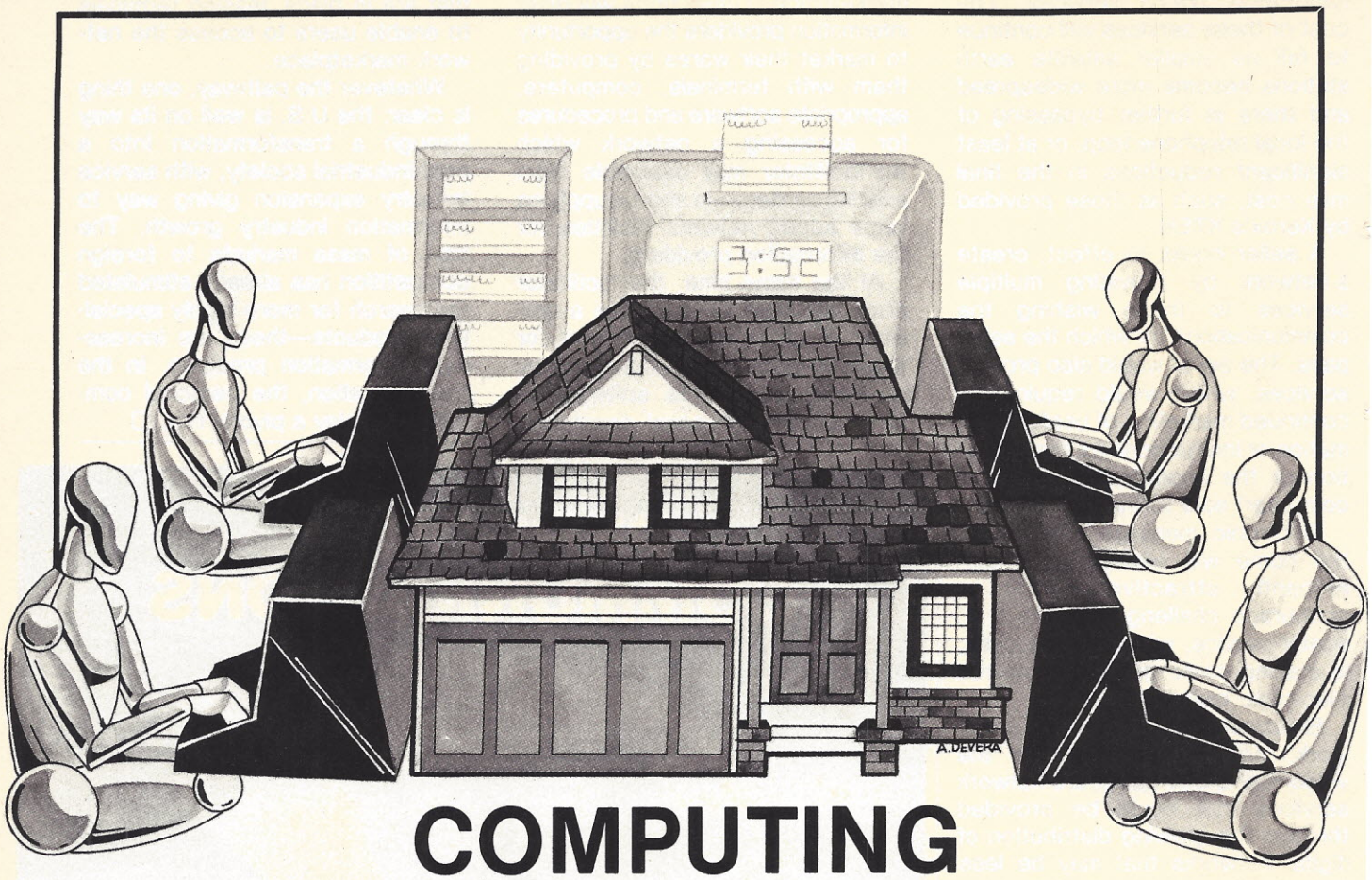
The ever growing availability of small earth stations, with their ability to reduce final mile charges, will lead to the consideration of Direct Broadcast Satellites. Combined with a relatively low cost home antenna, DBS could make broadband access universally available. This will be competitive to both the expansion of cable television and to the conversion of AT&T's national switched network to digital services, via the use of optical fibers.

Easing access to the network marketplace will become the business of information facilitators or middlemen, organizations that sell information services rather than computers, terminals, personal computers or communications, somewhat akin to The Source or Micronet. In the late 1970s, these firms offered raw computer power, packaged or specialty software and online services that included access to data bases which they may or may not own.

During the 1980s, these middlemen will begin to play a very significant role in shaping the emerging marketplace. These firms will offer information providers the opportunity to market their wares by providing them with terminals, computers, appropriate software and procedures for accessing a network which the facilitator may assemble from existing carriers—in short, supplying value added network facilities for the information providers.

At the same time, the facilitator firms will seek to assemble a network of users and purchasers for these services. This will be done by providing appropriate software to terminals and personal computers that are in place, leasing terminals to enable users to access the network marketplace.

Whatever the pathway, one thing is clear: the U.S. is well on its way through a transformation into a post-industrial society, with service industry expansion giving way to information industry growth. The loss of mass markets to foreign competition has already stimulated the search for more highly specialized products—these are increasingly information products. In the transformation, the personal computer will play a pivotal role. □



COMPUTING TO WORK

by Bernard Conrad Cole

Recently, social thinkers such as Alvin Toffler and James Martin have suggested that one of the consequences of advances in computers and telecommunications technologies is the emergence of the "electronic village." In this concept, white collar workers at major corporations, rather than working in centralized locations, will perform their corporate functions at home. They will be hooked up via remote terminals or personal computers to a central CPU at corporate headquarters over telephone or direct microwave links.

Numerous publications have devoted extensive space to the concept, suggesting that, except for a few minor problems, the "electronic cottage" is rapidly becoming a reality. These views may be a bit optimistic. There are more than a few minor problems, not only economic, but institutional, sociological and psychological.

Ultimately, in 10 or 20 years, the electronic cottage will be a reality to more than a handful of people, comparatively speaking. For the greater percentage of workers, and for most corporations, first must come the electronic suburb, the electronic neighborhood and the electronic village.

"Telecommuting" out of your home has several immediate and obvious advantages, not only to the corporation and to the employees, but to society in general.

One immediate impact would be on gasoline consumption. According to a study by University of Southern California's Center for Futures Research, conversion of about 10% of the urban commuter work force to telecommuting would save about 150,000 barrels of gasoline per day. Federal figures for auto gasoline imports during the height of the first oil crisis in 1974 was about 100,000 barrels a day.

A more subtle effect would be the decreased cost to state and local government maintaining present mass transit facilities. The present system is caught in a cost spiral that governments do not need in order to match growing demand.

The primary benefit to corporations would be that they would not have to provide office space that is now running between $1 and $10 per square foot per month, at a minimum, without including utilities or furnishings.

Despite these advantages, telecommuting is meeting considerable resistance. For one thing, there is the institutional and managerial inertia of most major corporations, as well as the economics. Some observers have referred in less gracious terms to this reluctance as a manifestation of an "edifice complex."

Surveys by SRI International, Menlo Park, CA, indicate that employers have strong fears about maintaining production standards in any kind of cottage industry, in place of loyal ranks of works at the office. Managers tend to shun the idea of supervising personnel who work outside the office, because they are trained to supervise people who are sitting there looking as if they're working hard.

Another problem not given sufficient consideration is the inherent sociability of human beings. Except for such loner types as freelance writers and computer pro-

grammers, most office workers who have participated in tests of the concept prefer to work in offices. They find the isolation of working at home unnerving. The corporate office environment has replaced the social function of the neighborhood and small town of a few decades ago and the village of the previous century. Most people build friendships and relationships with those of common interest, their coworkers.

Obviously, the solution is to find some middle ground between the two extremes and some mechanism to facilitate the evolution from one to the other. The USC study identified four evolutionary phases (figure 1). The first phase, centralization, is typical of most business entities today; that is, they consist of a monolithic group of workers at a single, central site. At this site, workers are organized into various functional groups related to the primary information product associated with each function. Although many major national organizations have regional offices in several parts of the country, each regional office is sufficiently large that it can be considered a centralized organization.

The next evolutionary phase is that of fragmentation. At this point, coherent subunits of the central organization break off and relocate elsewhere—the electronic suburb. The interorganizational communications boundaries are stretched and replaced by telecommunications or mail systems, while the intra-organizational communications remains intact.

The third phase, dispersion, involves the establishment of a series of scattered business locations of the firm in which organizational subunits as well as employees are dispersed—the electronic neighborhood or village. Here an employee reports to a local site because it is local, not because the headquarters of his organizational sub-unit are located there.

Thus, while members of the accounting department may have previously reported to a single fragmented location, these members may now report to one of several locations, using telecommunications to perform the interaction within the department that was formerly face-to-face. This form is similar in appearance to branching, except that it is not necessary that all the major functions of the organization be represented in a dispersed work site.

According to the study, there are significant differences in the transportation patterns that result from

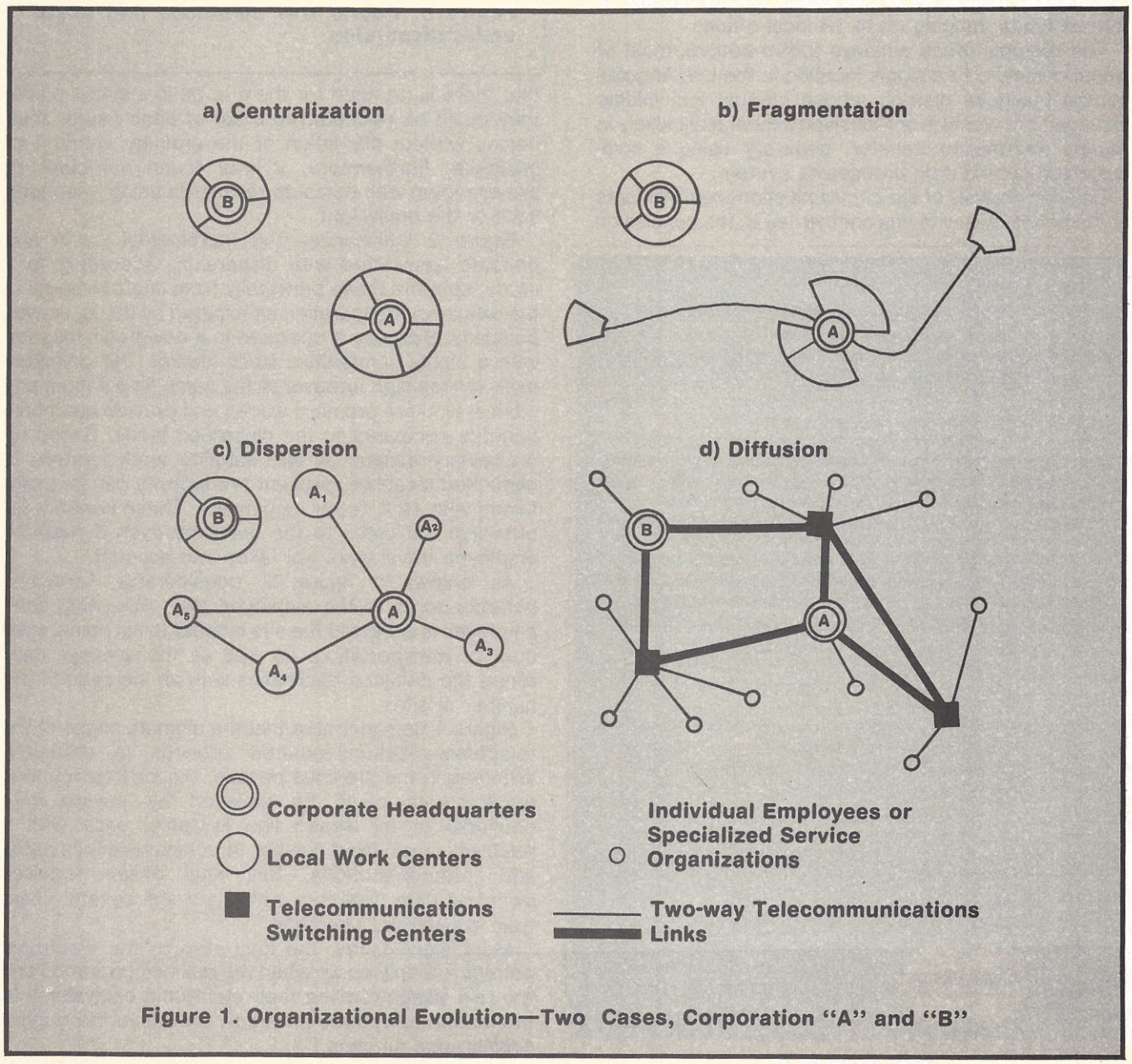


Figure 1. Organizational Evolution—Two Cases, Corporation "A" and "B"

these last two evolutionary steps. In the fragmentation or electronic suburb step, there can possibly be even a detrimental effect on the average commuting distance for employees. Some employees would travel a shorter distance to work at the new locations, but on the average, the net result would be an increase in transportation to work, at least until employee replacement provides a balance.

Change job—not location

In the dispersed case, substantial reductions are anticipated since each employee now travels to the location nearest his home. Furthermore, an employee can change jobs within an organization without changing his work location. This phase also allows expansion of a part-time labor market to include those, such as housewives and students, who otherwise would be unable to work because they do not have the time to commute to a central location.

Figures 2 and 3 show the result of a study of the economic utility of telecommuting on the regional administrative offices of a national insurance company considering operation in dispersed configurations of various types, ranging up to 18 local offices.

The regional office employs 2,500 people, most of whom commute to a single location in the Los Angeles central business district, whose clerical and middle management workers are involved almost exclusively in routine information transfer, generally using a computerized central data processing system.

Detailed analysis of the communications requirements of the employees with one another led to the conclusion that there is no need for them to be in a single place; they could be relocated to a set of sites nearer their homes without disruption of the ordinary conduct of business. Furthermore, it was found sufficient to provide them with computer terminals using telephone lines or the equivalent.

Annual Costs	$ 756,000
Annual Benefits	
Staff reduction	$1,326,000
Reduced turnover	341,000
Reduced salaries	778,000
Reduced fringe benefits	598,000
Total	$3,043,000

Figure 2. Incremental annual costs and benefits of decentralization

Number of Sites	Average Daily Round Trip Distance	Total Transportation Cost/Year
1	21.4	$1,470,000
5	16.2	1,110,000
10	11.6	800,000
15	8.0	550,000
18	7.0	480,000

Figure 3. Round trip distances and costs under dispersion

Figure 2 summarizes the incremental costs and benefits associated with dispersion. According to a study, benefits come principally from improvements in the efficiency of operation anticipated by the insurance company. Because it operates in a downtown location with a highly competitive labor market, the company experiences high turnover at the same time it must pay clerical workers premium wages and provide additional benefits compared to the dispersed mode. Based on preliminary studies at two satellite work centers in dispersed locations, present productivity can be maintained with 12% fewer employees. These benefits far outweigh the costs to the company even if reduced employee travel were not taken into account.

As shown in figure 3, considerable economic benefits acrue to the employee also. Assuming each employee is assigned the site closest to his home, total cost of transportation, as well as the average daily round trip distance decreases with an increase in the number of sites.

Figure 1 demonstrates that the ultimate phase in the telecommunications-induced process is diffusion. Whereas in the previous phases, the communications requirements could be satisfied by private data networks or by leased line systems, each with a relatively small, fixed number of communications paths and interconnections, this final phase requires switched data networks which are still several years from economical operation.

More significantly, the final step to the electronic cottage will only occur when the real neighborhood and the real village replace their electronic equivalents in the modern corporate structure and serve the original socialization function. □

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CIRCLE INQUIRY NO. 40

USC SEMINAR
A COMPUTER LAW FORUM

The Second Annual Computer Law Institute, sponsored by the University of Southern California Law Center (Los Angeles, CA), surveyed some provocative topics of vital concern to computer manufacturers and end users alike. The two-day session was conducted recently at the Bonaventure Hotel in Los Angeles.

The two main categories were Proprietary Rights in Data Products and Contracting for Data Processing Products. In this month's issue, the Proprietary rights topics will be highlighted.

This annual seminar is of special interest to the computer industry because it provides end users with new methods of protecting themselves from abusive sales techniques by unethical vendors. From the vendor point of view, it teaches how to preserve proprietary rights in products from unscrupulous end user pirates and demonstrates techniques for effective competition in the marketplace, bypassing the courts of law whenever feasible. Following is a topic-by-topic rundown of the seminar discussions.

Trade Secret Protection of Computer Software

One of the most impressive speakers was Roger Milgrim (Milgrim, Thomajan, Jacobs and Lee, New York, NY), practicing attorney and author of a three-volume treatise, *Trade Secrets*—an expert in his field. Computer lawyers look to him not only for his detailed knowledge of protection of proprietary property but also for his prophetic insights. His predictions of what developments are looming in the horizon provide important insight. A lawyer can get a "fix" on solving potential client problems before the client is injured in the marketplace.

Professor Milgrim surprised us with the following observation: "In the past ten years, the computer industry has switched its emphasis from behemoths (hardware) to spiritual concerns (software). The change in emphasis was metaphysical," he said. His point was that the dollar investment software equals or exceeds that of hardware. Software is now in need of protection.

Which area of the law will adopt software into its family of protective rights—patent, copyright or trade secret law? Patents and copyrights have not provided the protection necessary to a developer of a trade secret embodied in the format of a computer program. Patent protection has traditionally been *and continues to be* unavailable for stand-alone computer programs, that is, computer programs not integrated into a manufacturing process.

Unlike patent laws, copyright law has been somewhat more receptive, extending an invitation to software to come within the scope of its protection. Nevertheless, as Professor Milgrim pointed out, copyright law is unable to provide the protection necessary to prevent legal pirating.

Trade secret law easily encompasses software into its strong protection by lowering the admission price below that of patents and copyrights. To be patentable, an idea must be novel and not obvious—(a difficult standard to meet, argued the professor). Trade secret protection "covers any information not usually known that gives a business a competitive advantage." Milgrim then gave several examples of trade secrets: cost data, customer identity and needs, etc. His key point was that common knowledge obvious to all programmers can be legally protected as a trade secret when the *combination* of commonly known programming formats and elements is arranged in a particular manner to produce a result that is "generally not known."

The cardinal rule in trade secret law is anti-disclosure. Anti-disclosure implies proprietary monitoring. The professor used the term "headstart notion" to describe the idea that it is less expensive to misappropriate a trade secret from someone else than to develop it yourself. Such misappropriation can be countered by trade secret laws.

Milgrim was particularly concerned about the new copyright acts' preemption over state trade secret laws. Preemption is the legal doctrine whereby the federal copyright would displace the individual state's

trade secret protection laws. Milgrim pointed out the problem of the "ambulatory employee" who migrates from one company to its competitor with knowledge of trade secrets developed by the former employer.

He closed with a pragmatic endorsement of self-erasing software, a development that prevents unauthorized disclosure of trade secrets. This non legal approach avoids, he said, the extremely difficult problem of policing software infringement. But, Professor, do you foresee the development of an even more effective solution to the problem—a self-destructing software pirate?

Developments in the Law of Patent Protection of Computer Software

Edwin Taylor (Blakely, Sokoloff, Taylor, and Zoffman, Los Angeles, CA) is a patent lawyer whose expertise is in the field of patentability of computer programs.

Taylor presented a historical summary of the case law affecting the patentability of software. His summary culminated with a discussion of the two Supreme Court decisions Diamond vs. Diehr (software) and Diamond vs. Bradley (firmware). He was quick to point out that despite a flash of publicity surrounding the Diehr case (all of which he concluded was inaccurate), the issue of patentability of software is still in doubt.

Although Diehr and Bradley upheld the patentability of software and firmware respectively, Taylor indicated that neither case provided any clear guidelines for either the computer industry or patent lawyers seeking proprietary protection. Nor did either case clearly state that either software or firmware was patentable. In fact, the Bradley court, he insisted, went to great pains to point out that they were not deciding whether or not firmware was patentable. Taylor extracted the following principle: the more structure used by software as an integral part of a manufacturing process, the more likely it is that patentability will be granted.

Although Taylor did not specifically address mass marketed application packages, I believe that he would predict that their chances for patentability is nil. In his concluding remarks to the audience, he recommended that only hardware types should seek the route of patent protection in the future. Software types should shop elsewhere for protection.

Developments in the Law of Copyright Protection of Computer Software and Protection of Proprietary Rights in Data Bases

Fred M. Greguras (Kutak Rock and Huie, Omaha, NE) is a lawyer and frequent author and lecturer specializing in computer law and intellectual property.

Using the Computer Software Copyright Act of 1980 as a starting point, Greguras plunged into a technical discussion of the intricacies of the law of copyright of software and data bases.

At a brisk pace, he informed the audience that the 1980 Act expressly provides for copyright protection for computer software by amending the 1976 Copyright Act to add a definition of computer programs. The 1980 Act, he noted, protects only program images; it does not protect concepts, ideas, specifications, etc.

As Milgrim noted in his program materials, an estimated 10,000 programs were written every day in the early 1970s, yet the new definition of computer programs enacted into law 10 years later does not differentiate between application programs and system programs such as operating systems, interpreters and compilers. Nor does the 1980 act distinguish between object and source programs.

What is a copy? The 1980 act has not defined this. The National Commission on New Technological Uses of Copyrighted Works (CONTU) appears to recommend that a person who inputs a program is just as liable for infringement as if he or she photocopied a listing of the copyrighted source code.

The CONTU report did not recommend that the provisions of the 1976 Copyright Act preempt the use of state trade secret laws. Therefore, both copyright and trade secret protection appear to grant a dual legal base for protection of computer programs.

Greguras noted that one legal author has contended that federal copyright protection accompanied by state law trade secret protection is unconstitutional under the Supremacy Clause of the Constitution! I do not believe that this position is correct. Moreover, I am against limiting protection of computer programs, however stored, to one area of the law. The more areas of law that can apply to protect a computer program, the better. An owner or developer should be able to select from among several methods of computer protection that most closely fit his or her business operation.

Greguras concluded his remarks on copyright protection by recommending the visible placement of the copyright on the medium itself as well as notice on the program itself.

The next area Greguras discussed was the matter of data base protection. Of the three types of data bases (bibliographical, bibliographical and abstract, and full text entry), copyright protection can be achieved by several methods. The legal source of protection arises from the 1976 Copyright Act definition of "literary works," among which is the classification of "compilications"—the category where data bases belong. The CONTU report recommended that a data base can be copyrighted even though the data entries in the data base itself are not susceptible to copyright protection.

To the extent that a data entry may be copyrighted, the best form of copyright protection is to have the full copyright notice appear when the entry is accessed or displayed. NEXIS does this; it is, however, the most expensive way to go at $10 per copyright notice. This method treats each entry as a separate copyright work.

The next best method of achieving protection is to make the copyright notice appear when the data base is accessed and the entries are displayed. Lastly, state in the copyright notice of the data base that the publication date of the entry equals the copyright date, even though the data base copyright date may not yet be known.

Protection of Proprietary Rights in Chips and Chip Technology

Roger Borovoy is General Counsel and Vice President of Intel Corporation (Santa Clara, CA) and has lectured extensively in the field of computer law.

His short and colorful presentation included the Diamond vs. Diehr case, as he pessimistically pointed out that simply because a computer program is present in a patent claim, it will not in and of itself cause your patent claim to be rejected.

In a more confident vein, he expressed the feeling that the 1980 Copyright Act cast computer program protection into concrete. He noted that the act defined a computer program as: "a set of statements or instructions to be used directly or indirectly in a computer in order to bring about a certain result." He indicated that this did not void copyright protection for a program stored in read-only memory (ROM) or in a microcode in a programmed logic array (PLA).

The visible notice requirement of the Data Cash case spurred Mr. Borovoy to recommend that a copyright notice should be placed on, for example, the ROM, circuit board and storage cabinet. "There are no cases on overmarking," he remarked.

Trade secret protection, he felt, was the most viable for protecting manufacturing process details. Patents, he claimed, were too costly and lengthy to obtain. Once a product (for instance a chip) is marketed, trade secret protection fails because the program is divulged when the chip is sold.

The most interesting part of his presentation concerned Intel's policy with respect to the ambulatory employee who departs the company in possession of trade secrets that are useful to a competitor—or the backbone technology of a new company created by the departing employee.

Intel takes the following steps: employee signs new disclosure of trade secret agreement upon employment; occasional letter reminders are sent to employee identifying key technology areas; upon cessation of employment an exit interview is conducted identifying trade secrets; a letter regarding Intel's trade secrets is sent to the employee's next employer; an occasional lawsuit is filed where an employee flagrantly exploits a trade secret of Intel.

From my own experience, it's clear that employee non disclosure procedure as well as non disclosure agreements between the trade secret developers and third parties desiring to evaluate the technology for commercial gain are either improperly drafted or non existent in the microcomputer industry.

Protection of Proprietary Rights in Mass Distributed Software and Firmware Products

To describe the computer law pedigree of Susan H. Nycum (Gaston Snow and Ely Bartlett, Palo Alto, CA) would consume the next few pages. In addition to being America's leading authority on computer abuse, she is the American Bar Assoc.'s past chairman on Science and Technology—and an author as well.

By 1983 it is estimated that there will be 1 million more new mass market computer users than there are today. By 1985 shipments of personal computers will increase to 2 million units annually. The proliferation in microprocessors has now reached the point, she noted, where United Airlines was recently forced to announce that "the use of electronic games aboard United's aircraft has been temporarily banned because of potential interference with the aircraft's electronic navigation equipment." Just imagine an 11 year old boy scoring his first touchdown on an electronic football game only to subsequently discover that the last series of victory "bleeps" from the game has caused the plane to touch down not in Boston—but Calcutta!

The present user population is segmented into three categories. Hobbyists are a declining group. Businesses show a marked and discernible presence for prepackaged accounting and inventory control applications for in-house computer use. Quasi-Business includes such examples as freelance writers, moonlighting programmers, accountants, lawyers and homemakers.

To service this mass market (estimated by *Business Week* to expand from a 2 billion dollar market as of last year to 8 billion by 1985), microcomputer manufacturers are having to switch from the "naked" system to a "user friendly" system including software. Ms. Nycum calls this the "automatic transmission" model. For mass marketed software, she generally concluded that software is best protected by copyright law. Notable is that if you forget to place the © on a copy of your work, you do not lose your copyright under the new law.

For the remainder of her excellent presentation, she discussed the practical pros and cons of software protection in the mass market. She produced in her outline what she has entitled a "Decision Matrix" for choice of software protection, i.e., patents, trade secret or copyright laws based upon selecting the asset to protect. This could include algorithm or expression down through an evaluation of the ease of piracy of the asset (vis a vis the war chest available to legally protect the asset).

As the co-principal investigator of Stanford Research Institute's International Studies of Computer Abuse for the Nation Science Foundation and the Department of Justice, Ms. Nycum related the following examples of computer abuse revealed to her by the FBI that are *now in progress* (all by sophisticated "blue-boxers").

1) *Star Wars* scheme—a plan to reenact the *Star Wars* battle drama using real airplanes by plugging into air traffic controller's communication system.
2) Comstat—a plan to "bring down" a communications satellite.
3) Dow Jones—a plan to interrupt and manipulate the D-J average (not for commercial gain but for fun).

The Detection and Proof of Misappropriation

Ronald L. Johnston (Blanc, Gilburne, Peters, Williams, and Johnston, Los Angeles, CA) specializes in business litigation and focuses particularly on trade secret and unfair competition issues arising within the computer industry. In addition to being a frequent author and lecturer in his area of specialty, he is the founding chairman of this law institute.

Johnston opened his presentation by distinguishing between Susan Nycum's computer abusers for fun and games—i.e., mass disasters—and his own area of concern: profit seekers in the underworld of industrial espionage.

He initiated his technical discussion with a phrase coined by his partner Miles Gilburne, aptly entitled the "Orpheus Syndrome."

(A little mythological background is in order here.) Orpheus was the rock star of ancient Thrace. Instead of receiving royalties for his lyrics (including subsidiary and derivative rights protection for his poetry) he was compensated by rivers changing their course to his

tunes and trees swaying to the melody of his lyric poetry. (After all, what else would one expect from the son of Apollo?)

The lovely Eurydice, enchanted by this poet, became his wife. Soon after their marriage, she was bitten by a poisonous viper and died. Orpheus descended into Hades to find her. Pluto, ruler of the underworld, was so delighted by Orpheus' music, he permitted him to take back his bride if Orpheus would not look back at Eurydice as she followed behind him until they passed the Gates of Hades. Orpheus, at the Gate, fearing for his wife, looked back at her. She slowly receded back into Pluto's Kingdom, never to reappear.

The Orpheus Syndrome as applied to laws stands for the principle that after investing time and money to create a trade secret, a software developer may lose it in litigation that construes it as ambiguous or generalized knowledge, ineligible for trade secret status and protection. When a software developer "looks back" after the dust has settled in court, the trade secret has vanished.

Why? Johnston succinctly answered by stating that trade secret developers possess high intelligence, creative and technical skills and speak computerese. Jurors on the other hand are excluded if they possess technical knowledge. The judge only speaks leagalese.

In one computer trade secret trial, the judge recalled to the witness stand an expert witness who had testified on the technical aspects of the case. The judge wanted to know why it was that this expert had purchased for himself a Z80 microcomputer as opposed to a CP/M microcomputer!

The difficulty in convincing the jury that a trade secret exists, argued Johnston, is to draw the fine line between the programming design decisions that are the unique combinational approach to a given problem vs. the functional similarity common to all programming skills.

Some important technical methods of detection mentioned by Johnston include latent errors or peculiarities in the program that surface in the disguised "new" product. In one case 98% of the logic of the program has been changed, but the schematic and flowchart mneumonics were the same as the copies program. Technical people and software folk can discover if copying has occurred by noting spaghetti codes and "go tos."

Intelligible interface between computerese and legalese is difficult enough. Johnston demonstrated how, explaining that the intricacies of software trade secret to a non technical jury can lose the case by the babel of languages.

What about using an arbitration panel of computer knowledgeables? Yes and no replied Johnston. The determination is based on the facts and circumstances of each case. The point: User's counsel does not want a vendor-biased arbitrator and vice versa.

Antitrust and Unfair Competition Considerations in the Protection of Proprietary Rights in Data Processing Systems

Michael Scott (Smaltz and Neeley, Los Angeles, CA) specializes in complex litigation and computer law. He is the executive director of the Center for Computer Law and editor-in-chief of the *Computer Law Journal*.

Bypassing the technical discussion of the various acts like the Sherman Act, Clayton Act, Robinson-Patman Act and the Federal Trade Commission Act (all or part of which slap down illegal monopolistic and illegal "tie-in" arrangements), the presentation can be categorized into two brilliant focal points.

Firstly, a computer products developer needs strong if not monopolistic protection (is not a patent a monopoly?) for his other creations. Antitrust laws, on the other hand, bust up monopolistic practices that result in the restraint of trade. The question posed to the antitrust lawyer is thus: At what point do a computer products developer's business practices violate the American antitrust statutory pattern? If a given business practice is not, per se, in and of itself illegal, the courts apply a Rule of Reason test to determine if the business practice constitutes a violation.

The second part of Scott's presentation offered a penetrating insight into the grey area within which the Rule of Reason operates. He defined the birth through death cycle of a technology company.

First is the embryonic phase. The company founders start their embryonic journey into the marketplace with little capital and only a patent, copyright or trade secret. At this stage, the company has low visibility with the government, competitors, and, unfortunately, in the marketplace. Price fixing from company through dealer and distributor—with a view toward restricting the price that the dealer/distributor charges the end user—begins to appear. Also making their appearance are illegal post sale restrictions placed upon dealers carving out territorial sales areas and illegal restrictions placed on re-sale by end users.

Following is the growth phase. A massive dose of venture capital spurs the geometric growth of high tech companies. The sales force increases; new products emerge; management wants sales made. Price discrimination, dealer kickbacks, samples, advertising allowances and illegal tie-ins all enter the picture. An illegal tie-in occurs when a slower moving product is tied into a highly desired product in order to bootstrap sales of the slower product: to get what you want you must also purchase what you don't want. An example would be tying CPU sales to operating software. Competitors emerge; they seek to shrink your boundaries, sue you or turn you in to the Department of Justice Antitrust Division. Scott suggested a key planning pointer. Train sales staff in an Antitrust Compliance Program: One sale is not worth a company made a defendant in a treble damages antitrust case.

Third is the no-growth or leveling off phase. Management becomes increasingly more radical in trying to recapture the company's position on the fast profit track. Just about anything goes at this state.

Finally is the decline to death phase. Management goes berserk and pulls out all the stops in its business plan to generate sales. At this point, the Rule of Reason may help a company in trouble by permitting it a business practice bailout philosophy that would be considered a violation were the company in better financial health.

Next month's regular Jurisprudent Computerist *column will focus on the second half of the seminar, Contracting for Data Processing Products. Included will be a summary of key tactics that end users and vendors can employ in achieving their performance and market goals.* □

LET YOUR COMPUTER

WRITE ITS OWN PROGRAMS

by David D. Busch

Wouldn't it be nice if your microcomputer could write its own programs? Though computers were originally conceived as a servant of mankind, any programmer who has slaved over a keyboard until early morning may feel as if the situation is the other way around. For the microcomputer user, the self-programming computer is still some time in the distant future.

Or is it? There are three things that computers have a knack for: processing data, controlling functions, and constructing designs from smaller building blocks. The first two are simple enough. Ask a computer to add 367 to 598, and it will happily comply. Tell it to send a signal to port X whenever it receives input from port Y, and a computer will gladly control your carburetor, monitor your house, or keep your Boeing 747 on course.

When a human is available to provide a list of criteria and parameters, a computer is entirely capable of combining components from an existing library to assemble, or design a complex product. A computer program is nothing more than a design to accomplish a desired task. Once a human being has determined how to get from point A to point B, it's entirely practical to have a computer choose from a library of subroutines to put together a program.

The following program for a TRS-80 model I illustrates the basic concept. It will ask the user for certain program parameters, such as whether a menu is needed, whether or not data will be stored in a string array, size of the array and other information, and then "write" a Basic program skeleton that conforms to these parameters.

The sample run that follows was written by Program Writer. The array in line 110 was created and

DIMensioned according to user input requirements, just as the menu was constructed, and subroutines allocated for later work by the human programmer. Two subroutines relating to disk I/O were actually entirely written by the program. The finished code was then saved to disk.

The program was written to demonstrate how a computer can be used to generate its own code. Therefore, it has purposely been kept fairly simple so that the logic can be easily followed. It includes these capabilities:

1) Ask the user for beginning line number, and desired line number increments.
2) Ask if a string array will be used to store data, and, if so, allow the user to specify whether the array will be one or two dimensional. The elements that should be DIMensioned are also input.
3) A menu of reasonable size (i.e. which can fit on a single screen) may be specified. Each choice can be described. Program lines to print the menu to the screen will be created, along with an "enter choice" prompt.
4) Each menu choice will be assigned a subroutine line number—marked with a REMark—so the programmer can flesh them out later. An " ON CH GOSUB..." line will be created, sending control to each of the menu subroutines.
5) Disk file I/O subroutines are automatically created that will save or load data stored in a one or two dimensional array.
6) The user can also specify several other subroutines, such as CLS:PRINT:PRINT, and A$ = INKEY$: IF A$ = ""GOTO...

The program will, then, create the basics of a simple data base management program to be completed by the programmer. It doesn't *complete* the program, but does save a great deal of typing time.

Modules create Basic code

Let's look at how it works. It consists of a series of modules, each designed to "create" a specific type of Basic code. The mechanics are simple. The lines of the target program are assembled from the library of built-in words and phrases. As each line of the target program is completed, it is stored in a string array, LN$(n). The particular element of LN$(n) is determined by a counter, CU. Each time a new target program line is initiated, control is sent to a subroutine at line 70. There, the line number of the target (LN) is incremented by IC (LN = LN + IC). IC is specified by the user. Next, CU is increased by one so that the new program line will be stored in the next available element of LN$(n). Finally, the new line number (LN) is converted into a string, and assigned as the first part of LN$(CU), along with a pair of spaces.

For example, if LN = 100 and IC = 10 when control is sent to line 70, LN$(CU) will equal 110 when it returns. So, each element of LN$(n) will begin with a line number, usually larger by IC from the previous element. The exception is when LN has been given a different value somewhere else in the program.

The first modules created for the target program are simple housekeeping lines for the beginning. The initial line of the program will CLEAR two thirds of the memory. Next, the program asks the user whether or not a string array will be used to store data. If so, the number of dimensions are input into variable DI. If DI = 2, the user is asked to provide the desired size for each of the two dimensions (ROW and COL). If DI = 1, only ROW is used.

The target program line is created by combining (in lines 250-270) the line number (already stored in LN$(n), remember) with DIM, and the array dimensions, enclosed in parentheses. If a two dimensional array has been specified, an additional line is developed that

The user inputs number of choices for the menu

defines variable NC (number of columns) equal to COL. NC is used later in the target program to control disk input and output.

If a menu is needed, the program obligingly creates a line that labels one (line 340). Note that to make a PRINT statement, it is necessary to combine PRINT with quotes around the material to be printed. CHR$(34) (quotation marks) is stored in P1$, and this string variable used whenever quotation marks are desired in the target program.

The user is asked to input the number of choices required for the menu. If DI = 0 (that is, no string array was dimensioned), the program assumes that disk file I/O will not be required, and does not offer the choice of taking advantage of the built-in disk I/O subroutines. Of course, disk files consisting of nothing but numeric values are possible. But, the greater flexibility of storing both string and numeric data as strings (and then converting to numbers with VAL, as needed) makes it simpler for the program to assume that disk files will be loaded into and out of a string array only.

If a string array has been specified, then the user is asked if "Save file to disk" and "Load file from disk" will be included in the menu. If so, IOFLAG is set to 2.

The user has told the program how many choices will be included on the menu. This value is transferred to CH (line 410), which is used as a parameter for a FOR-NEXT loop that allows input of the names of the menu choices. If the built-in disk I/O routines are desired, two is subtracted from CH, so that the user does not have to bother to input these. That is, if five menu choices will be used, but two of them will be for disk I/O, the programmer has to enter only the other three, in lines 430-460. Then, the menu display lines are created for all but the disk routines (lines 470-500). These are built in line 520.

Now things begin to get a little tricky. For each menu choice, the program has to create a subroutine location for the target program to branch to. Space has to be allocated for these. So, instead of using LN, and incrementing it by IC, another variable, NU, is used instead. NU is incremented by IC*50 for each of the menu subroutines.

For example, if IC = 10, each subroutine will be spaced 500 lines apart from the others. The starting line numbers for each menu subroutine is stored in an array NU(n) (line 560).

Next, a string representation of each menu subroutine starting line number is needed (for an ON CH GOSUB 500, 1000, 1500, etc. statement). These are assembled in line 570, with a comma tacked onto the end.

Next, an INPUT "ENTER CHOICE :";CH$ line is created for the target program. An error trap is also built. When the target program is run, if VAL(CH$) is less than one or is greater than MI (the number of menu choices available), the input is refused by a line created in line 630.

All these subroutines in the ON CH GOSUB... line will eventually RETURN, so control is sent back to the beginning of the menu. It's starting line number had been stored in IM(1) earlier, and is used in line 670 to build a control-branching instruction.

REM is inserted

To aid the programmer in finishing the skeletal program, a REM is inserted at each control to a REM line (these might be deleted later), so don't just begin writing the code at the next available line number following the remark.

This portion builds a simple disk input module, which will ask the user a file name, open that sequential file, input from the file the number of items in the file, and then begin a FOR-NEXT loop from 1 to the number of items in the file.

Within the loop, INPUT #1 loads the data. If the relevant array is two-dimensional, a nested FOR-NEXT loop, from 1 to the number of columns (NC—defined early in the program), is used. Actual construction of the disk input module is fairly clearcut. Its mirror-image twin is the Create Disk Output routine (lines 990-1210), which performs its own function nearly identically.

Other modules that are frequently needed can be added to the program's library as required. I used a "clear screen" and INKEY$ routines as examples. You are free to add your own favorite subroutines as you desire.

The final portion of the program saves the finished target program to disk under any desired legal name. A non-compressed (ASCII) file is created, which may be loaded, finished, debugged, and used as desired.

Program Writer is simple enough to form the basis for a much more complex code-generating system. A big drawback is the need to anticipate just what capabilities will be needed in the finished program. If a subroutine isn't in the program generating system's library, or if the parameters are beyond its capabilities (i.e. a three-dimensional array is required), the necessary code will have to be built up from scratch. It's still beyond the capability of microcomputers to use logic to create. Our silent servants must wait for instructions from us before doing anything at all, no matter how simple.

In next month's issue, the computer-aided program design will be carried one step further, as we introduce Instruction Writer, a program that develops documentation. □

Program on page 150

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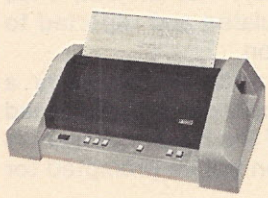

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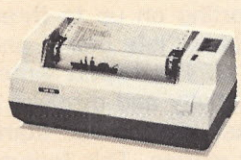

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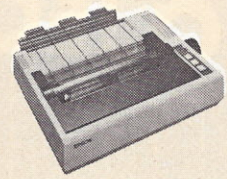

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A CRITICAL PATH METHOD OF PROJECT CONTROL

by Rocky Smolin

It doesn't take much experience in the world of business to understand why many projects get into serious trouble, or even fail, somewhere during execution: lack of adequate planning and a means of tracking the progress.

There are many methods of controlling the complexities of a project, but the two most widely used are PERT (Program Evaluation and Review Technique) and CPM (Critical Path Method). PERT is used on projects where the length of time and the costs are not easily determined. The best estimates of the activities are collected into a PERT network, the network is subjected to a randomizing algorithm and the probabilities of duration and cost are computed. This approach may be acceptable for government work, but when your bottom line is at stake, something more concrete is required.

CPM is probably the best project scheduling and control method for business. Its purpose is to gather activities into a dependency network for the purpose of calculating when each activity can and must start. It also determines whether that activity can be completed without adversely affecting the accomplishment of any other activity.

Simple CPM networks can be calculated manually. Even complex projects can be laid out on chart paper, but the time this takes for projects with more than 25 tasks becomes prohibitive. Further, if there are any modifications, it takes time to adjust the start and end times, and redraw the chart, making certain that you haven't overlooked any dependencies or left too much slack time.

CPM is ideal if implemented on a computer where updates to your network and recalculation of your schedule can be done automatically. Up to now, these packages were available only on larger machines. To a small business this meant timesharing or a heavy investment in on-site computer power.

Now, there is a full feature CPM package available for the TRS-80 model II—the Project Management System (PMS) by North America Mica, Inc., San Diego, CA. It is a complete set of tools to aid a manager in the construction, calculation, maintenance, and reporting of a project that has up to 500 activities.

The system allows for the construction and maintenance of a calendar of holidays for up to 100 holidays of any length and will calculate the project's critical path based on 4, 5, 6, or 7 workdays per week. The update facility makes the recording of actual information about cost, completions, starts, and changes in dependency and/or duration easy. The project, once updated, can be quickly recalculated and reported to check the exact current condition.

For aid in budgeting, each network can carry a burden percentage for automatically extending planned labor dollars to burden dollars. If the burden percent is set to zero, each planned burden will be prompted for as required.

The program will accept three levels of grouping for each activity. This would allow the network builder to assign, for example, responsibility for a given task to a division, then to a department within that division, and finally to an individual within that department. This is a very useful feature for preparing reports, showing just the activities for a division, a department, or an individual.

The report writer will allow sorting on up to three items from the grouping levels plus "late start" and "early start" fields (see figure 1). The report writer determines the status of each activity and displays a status message (can start, past due, must start, complete and active) in the right margin. This feature highlights accomplishments, as well as those activities requiring attention.

After generating the activity report, PMS will produce a gantt chart (figure 2) in "late start/early start" order, which gives an easy visualization not only of the activities in the network, but also which are critical, how much float time each has, and how long each should take.

The most critical phase of project planning with PMS is the construction of a network that defines the relationship of all activities within the project. The best way to do this is to construct an AOA network (activity-on-arc). Figure 3 shows a sample AOA network, which is included on the diskette as an aid to learning the system's operation.

The rules and symbols used in preparing an AOA network are as follows.

- Circles are used to indicate a moment in time when an activity starts or ends. These moments are referred to as nodes. SNODE = start node, ENODE = end node.
- Arcs (or straight lines) are used to connect nodes and a directed arc connecting two nodes is referred to as an activity.

- Networks must start with SNODE = 1.
- An activity's SNODE/ENODE cannot be used more than once.
- Dummy activities (duration = 0) can be used for totally parallel activities (i.e., 10-30: do something, 10-20: do something else, 20-30: dummy that insures both are done before continuing to 30-40: do next thing).
- Dummy activities are shown with dotted lines (see figure 3).
- Duration is always in elapsed days. Person-days to elapsed days is the responsibility of the project manager.
- Durations that are unknown can be automatically estimated by entering values for best-case, worst-case, and most likely PMS will calculate a weighted average and display the result (these are the three figures that appear along each activity arc in figure 3. Where the exact duration is known, that figure is entered for all three values, as in activity 30-40).

With this accomplished, the manager can enter the network and begin to focus attention on completing the project while PMS takes care of scheduling, tracking, and reporting far more economically than any manual method. It has been estimated that controlling a project with a computerized system can save as much as 75% of the administrative cost and can descrease the actual cost of accomplishing the desired result of the project by as much as 25-30%.

The package is very user-oriented, requiring a minimum of manual studying and practice. The screens are user oriented and the prompts are friendly. As noted above, a sample network has been included as a means for the user to become familiar with features and functions.

Figure 4 shows the main menu. Option 6 will allow the construction of the holiday calendar and should be run first. Option 9 must be selected at the beginning of each session to tell PMS which network you wish to process. The project name can be any unique combination of six characters, A-Z and 1-9. The system allows password control to prevent unauthorized access to confidential networks.

After adding all your activities under option 1, option 3 will calculate the start/stop dates for the network. The screens for adding and updating header and detail information are shown in figure 5.

Option 8 is a mini-CPM system, which will allow the input of activities like manufacturing routines that are not day oriented and do not have on-going processing requirements. For this class of projects, mini-PMS will calculate in units. A unit can be any period of time that the user requires. The mini system will handle up to 200 activities of up to 32,767 units in duration.

This program is an example of how desktop microcomputer systems under $10,000 are being used to perform functions formerly available only on million dollar machines. This availability signals a new era for American productivity, as the efficient and effective execution of complex tasks becomes possible for more and more small businesses through the use of microcomputer technology. □

Figures on page 152

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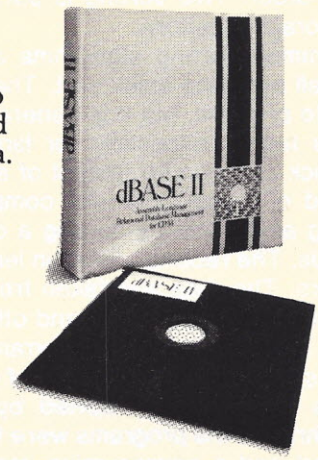

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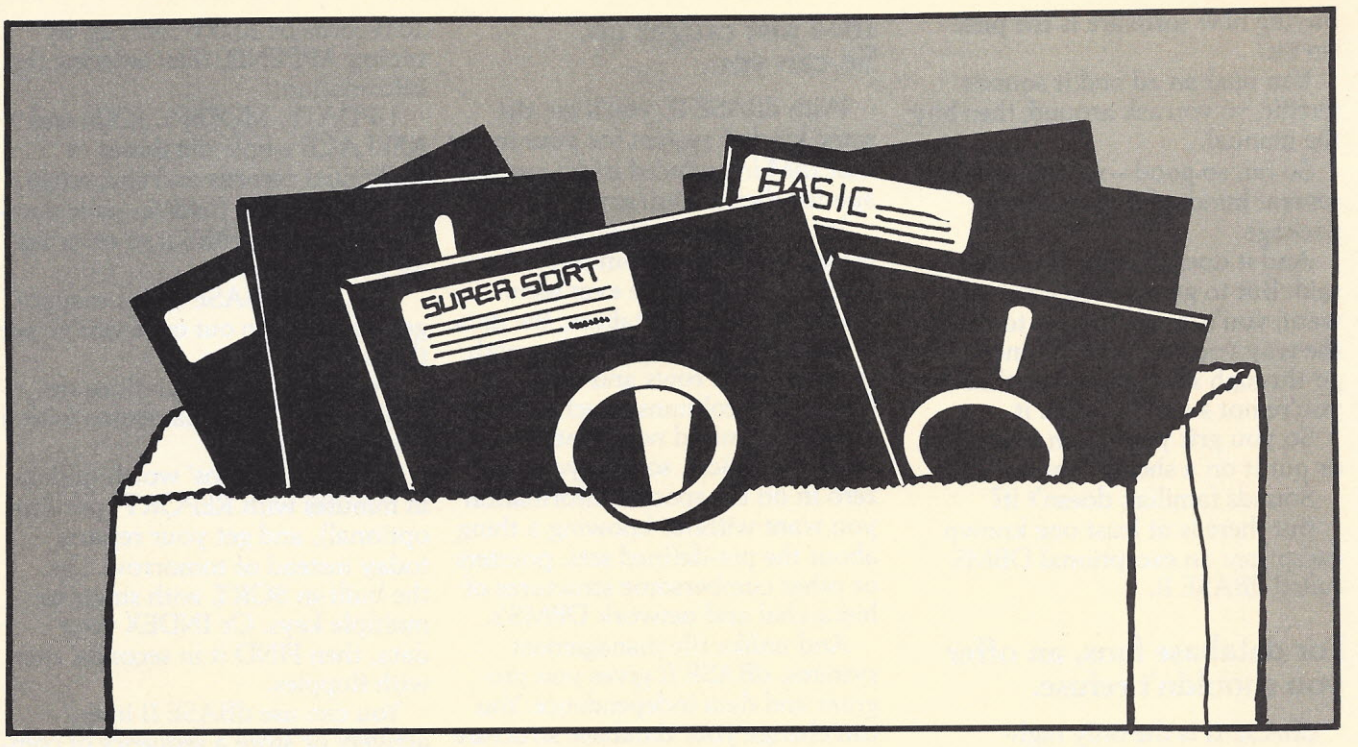


Super-Sort for CP/M

Versatile Sorting Package

by Alan R. Miller

Sorting business records into alphabetic order and lists of data into numeric order are common computer activities. Many different sorting algorithms have been developed for this purpose. Some work faster when the data is nearly sorted, but some are slower under these conditions.

Most sorting routines utilize only the space occupied by the original data, but some implementations utilize additional working storage. For example, Spellguard (IA Jun 81) initially adds new words to the end of the dictionary. But every so often, the dictionary, contained in a very large disk file, is automatically reorganized into alphabetical order. This sorting is performed without additional storage locations.

Three common sorting algorithms are the bubble sort, the Shell sort, and quick sort. The bubble sort is the easiest to program, but it is generally the slowest. Shell sort is faster, especially for large numbers of records. Quick sort can be fastest of all.

The speed of Super-Sort was compared to these three sorting algorithms by sorting a disk file of 252 string records. The records varied in length from 60 to 80 characters. The data was taken from a mailing list consisting of names, addresses and other ASCII information. The file was formed by rearranging an initially ordered list, so there were short runs of ordered blocks.

The same file was then sorted by five different programs. Three of the programs were the bubble sort, the Shell sort and a nonrecursive implementation of quick sort. The source program was written in Basic and compiled into binary code by Microsoft's BASCOM. Compiled programs typically run about ten times faster than the interpreted version.

The fourth program was a duplicate of the quick sort routine running in interpreter mode with Microsoft's Version 5 Basic-80.

The fifth program was Super-Sort by MicroPro of San Rafael, CA. The time for each run included reading of the data file from the disk, actual sorting of data, and writing of sorted data back to disk. If the actual sorting times are compared, the differences between the different algorithms will be much greater.

The results of the first test are given in figure 1. The quick sort routine, running with the Basic interpreter, is the slowest of the five. (Of course, the bubble sort running under the interpreter would be even slower.) The compiled bubble sort was about twice as fast. The compiled quick sort and compiled Shell sort were faster yet. Super-Sort was clearly the fastest of all.

Since some sorting algorithms are sensitive to the original order of the data, two additional sorting runs were made. The newly sorted disk file was used as the starting point for the next series of tests, that is, a sorted list was "sorted". Figure 2 shows that Super-Sort is best in this case also. Notice that the bubble sort is now the same speed as the other two Basic routines.

As a final test, the first record in one of the sorted files was moved down to the middle of the file. This might represent the situation where the name of the client is changed. Figure 3 shows that Super-Sort is best again.

Super-Sort is much more than a simple sorting program. Many different options are available at

execution time. First, the user indicates the nature of the records, whether of fixed length (blocked), delimited by a carriage return, or of varying length (binary). Field type is also indicated as positional (ASCII), or comma separated (numeric data). Upper and lower case letters can be considered the same for sorting purposes. This is essential for sorting records typed by different employees.

The parts of each record used in the actual sorting operation are known as keys. For blocked ASCII records, these can be chosen by column position. Alternately, the keys can be chosen by field if the data is numeric and separated by commas. Sorting in either increasing or decreasing order can be selected.

Several fields can be chosen, and increasing or decreasing order can be selected independently for each field. Thus, a list of customers can be sorted by the zip code field. Then, within each field, the records can be sorted by city. Finally, the records within each city can be sorted by name. An additional feature allows the selection of only a portion of a given file. For example, all customers with zip codes 94XXX can be chosen.

Seconds	Algorithm
20	MicroPro's Super-Sort
30	BASCOM version of quick sort
30	BASCOM version of Shell sort
60	BASCOM version of bubble sort
105	Interpreted version quick sort

Figure 1. Time to sort 252 mixed string records

Seconds	Algorithm
18	MicroPro's Super-Sort
30	BASCOM version of quick sort
30	BASCOM version of Shell sort
30	BASCOM version of bubble sort

Figure 2. Time to sort 252 sorted string records

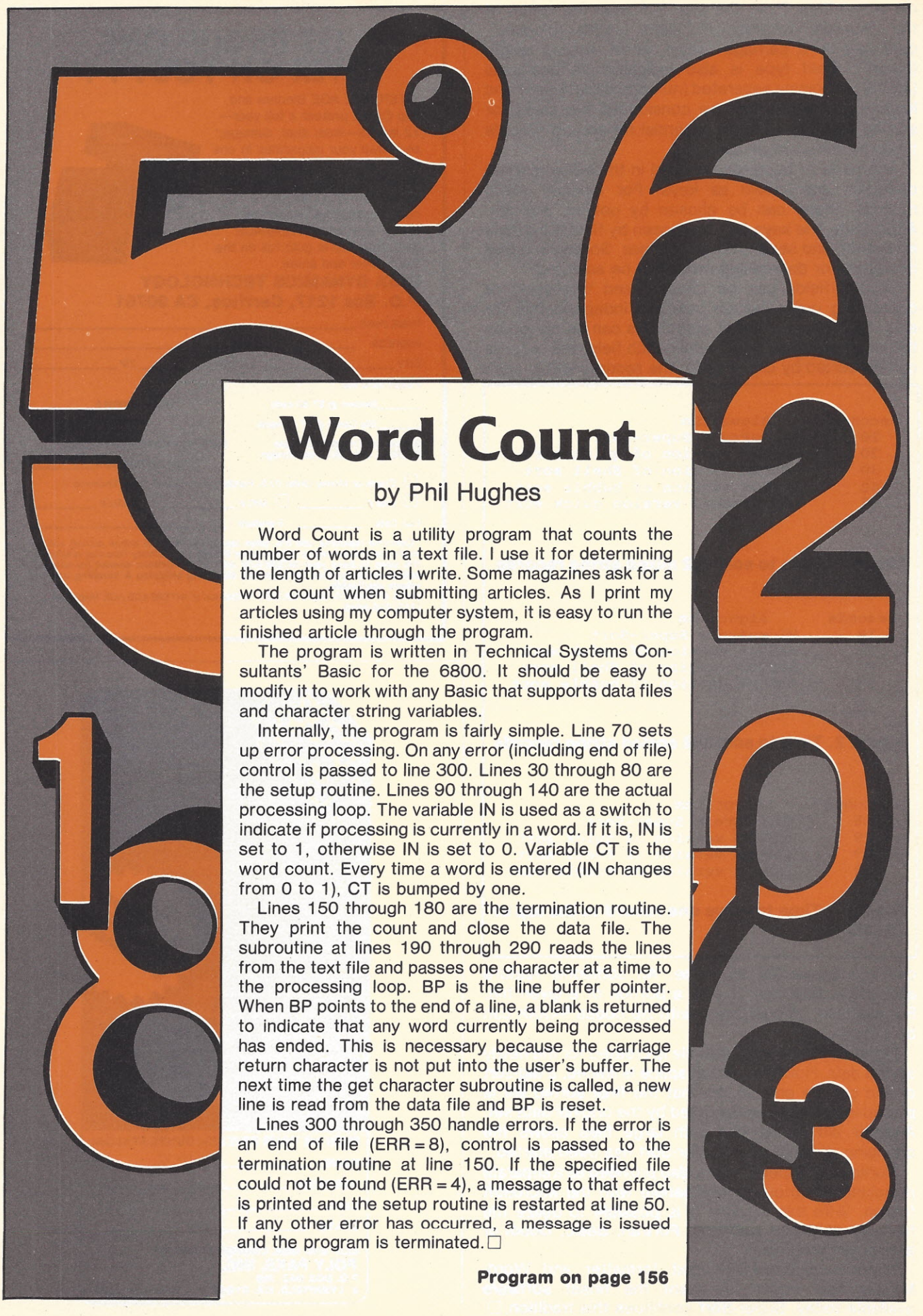
Seconds	Algorithm
18	MicroPro's Super-Sort
29	BASCOM version of quick sort
29	BASCOM version of Shell sort
53	BASCOM version of bubble sort

Figure 3. Time to move one record to the top of the file

Normally, a separate disk file is created for the newly sorted data. However, if disk space is limited, a tag-sort option can be chosen, so that the final sorted list is placed into the space occupied by the original data set. Another aid to working with large files allows the changing of disks after Super-Sort has been started.

Portions of Super-Sort are also provided as a separate relocatable subroutine compatible with the Microsoft format. With this module, it is possible to utilize the features of Super-Sort from Fortran, Basic, Cobol or assembler programs.

MicroPro's Word-Star text formatter and Word-Master text editor represent the finest software available today. Super-Sort continues this tradition. □



Word Count

by Phil Hughes

Word Count is a utility program that counts the number of words in a text file. I use it for determining the length of articles I write. Some magazines ask for a word count when submitting articles. As I print my articles using my computer system, it is easy to run the finished article through the program.

The program is written in Technical Systems Consultants' Basic for the 6800. It should be easy to modify it to work with any Basic that supports data files and character string variables.

Internally, the program is fairly simple. Line 70 sets up error processing. On any error (including end of file) control is passed to line 300. Lines 30 through 80 are the setup routine. Lines 90 through 140 are the actual processing loop. The variable IN is used as a switch to indicate if processing is currently in a word. If it is, IN is set to 1, otherwise IN is set to 0. Variable CT is the word count. Every time a word is entered (IN changes from 0 to 1), CT is bumped by one.

Lines 150 through 180 are the termination routine. They print the count and close the data file. The subroutine at lines 190 through 290 reads the lines from the text file and passes one character at a time to the processing loop. BP is the line buffer pointer. When BP points to the end of a line, a blank is returned to indicate that any word currently being processed has ended. This is necessary because the carriage return character is not put into the user's buffer. The next time the get character subroutine is called, a new line is read from the data file and BP is reset.

Lines 300 through 350 handle errors. If the error is an end of file (ERR = 8), control is passed to the termination routine at line 150. If the specified file could not be found (ERR = 4), a message to that effect is printed and the setup routine is restarted at line 50. If any other error has occurred, a message is issued and the program is terminated. □

Program on page 156

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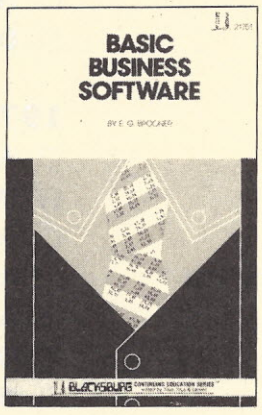

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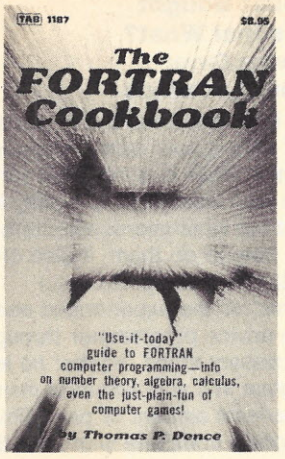

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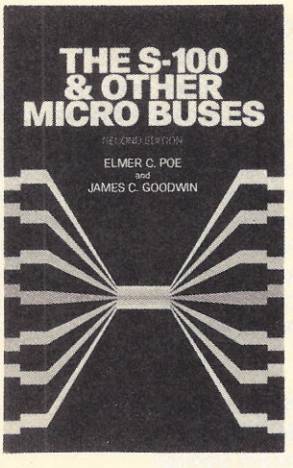

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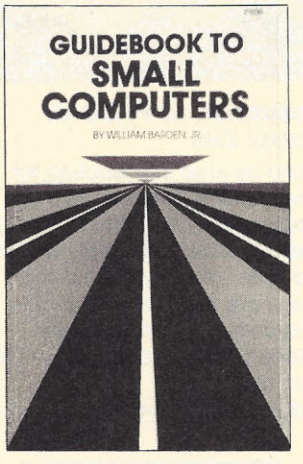

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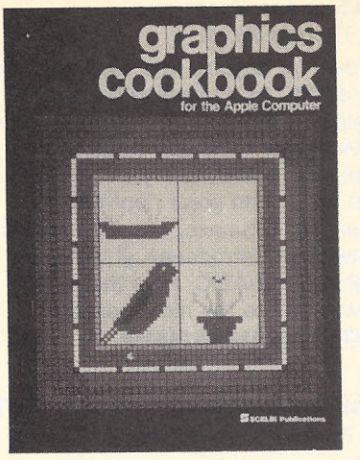

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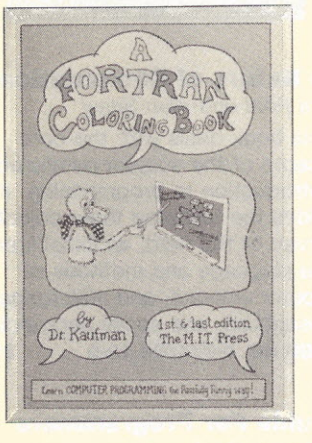

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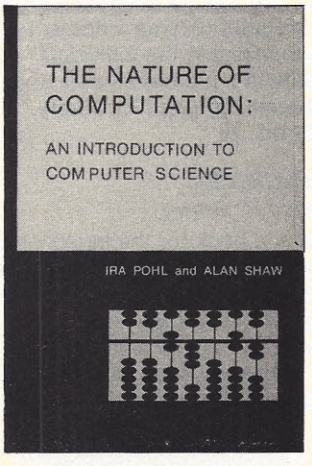

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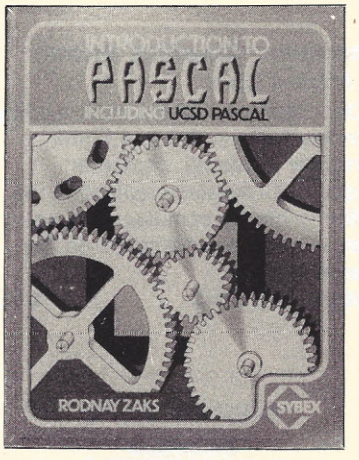

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This book presents the first step toward writing your own computer programs. While it is intended for anyone who would like to simply know more about what microcomputers can do and how to do them, it also offers a substantial amount of useful programs for the experienced user. It takes a novice programmer through the necessary steps, so that he learns to program in a sophisticated manner with the least amount of pain. This book comes complete with over 50 programs written in the Radio Shack TRS-80 BASIC, and over 60 photos and illustrations.

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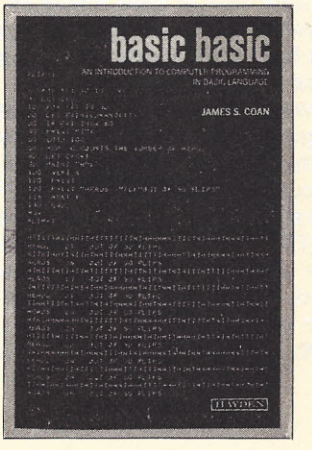

BASIC: BASIC
By James S. Coan

The author uses over 100 sample programs to illustrate the essential techniques of the language and to integrate BASIC programming with mathematics. Each language statement or capability is clearly explained at the time that it is first used in a sample program. Every section is followed by practice problems.

ORDER NO. 0-8104-5106-9 $9.45

Beginners Manual for the UCSD Pascal System
By Kenneth Bowles

This book is designed to be used both as an orientation guide for people first learning to use the UCSD Pascal System, and later as a reference manual with the system. As a reference manual, the book contains enough information to assist in a wide variety of advanced applications of the system. However, advanced users should probably supplement the book with the detailed reference manual for the system issued by the UCSD Pascal project.

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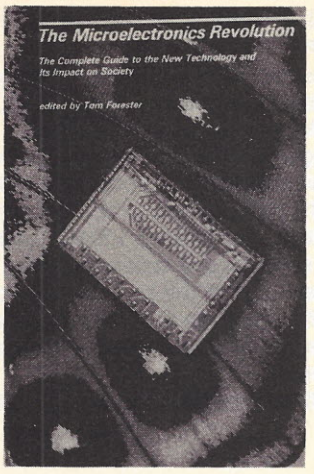

The Microelectronics Revolution
Edited by Tom Forester

Although microprocessing equipment has only been available for a short time, its impact is already being felt, in the office, home and factory. This book details the impact of this new technology on society in separate chapters which take up automation on the factory floor, the word-processing revolution in the office, the consequences for employment, and the implications for industrial relations.
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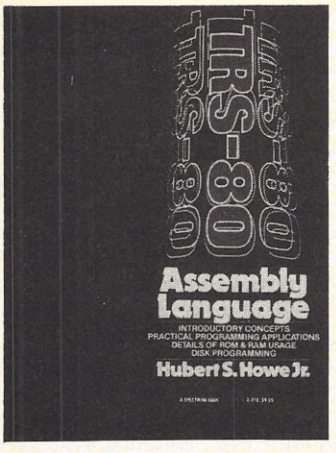

TRS-80 Assembly Language
By Hurbert Howe, Jr.

For the first time user, as well as the experienced user of the TRS-80 microcomputer, here is a book that explains assembly language programming in a thorough, yet easy to understand style. This book contains all the information anyone might need to develop machine language programs. There are presentations of all introductory concepts, completely tested programs, comprehensive tables, charts, and appendices.
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Principles of Interactive Computer Graphics
By William Newman and Robert Sproull

A truly comprehensive guide to interactive computer graphics, this unified, rational resource ranges from the essential principles of interactive graphics to a completely cohesive strategy for designing graphics systems. Each chapter provides cogent discussion of alternative solutions to specific problems, and shows how these solutions relate to the overall design of a graphics system.
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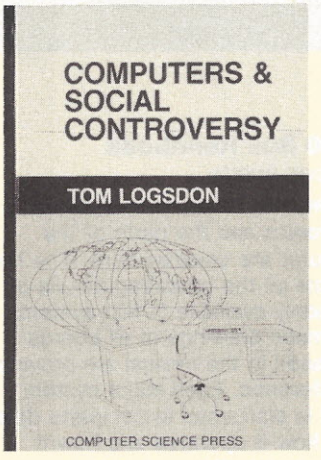

Computers and Social Controversy
By Thomas Logsdon

The use of the computer in our society has grown enormously, and it continues to grow at a prodigious rate. This book examines the social consequences that the use of computers will eventually bring. The impact of computers is explained in a lucid and enjoyable style. After a review of current computer technology including mini and microcomputers and their use as personal computers, the author examines seven major areas of computer impact. These include computers and privacy, crime, education, artificial intelligence, automation, consumerism, and banking.
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Foundations of Computer Science
By M. Carberry, H. Khalil, J. Leathrum and L. Levy

Introductory computer science texts are frequently devoted entirely to programming and neglect many other topics that should be covered. In addition to complete coverage of programming related subjects, algorithms, flowcharts, program correctness, and stepwise refinement, the book also covers hardware, parsing, control structures, data structures, artificial intelligence, Turing machines, social aspects, applications and pocket calculator programming.
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Inside BASIC Games
By Richard Mateosian

Explains how to design games programs in BASIC. Presents fully detailed explanations of all types of games ranging from educational to chance. Each game is described and analyzed so the reader may play the presented game as well as learn to write programs for other games.
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The PASCAL Handbook
By Jacques Tiberghien

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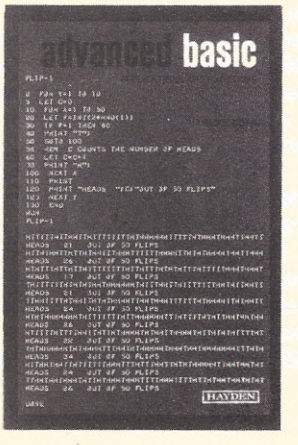

Advanced BASIC
By James S. Coan

This book is for those who want to extend their expertise with BASIC and offers advanced techniques and applications, including coordinate geometry, area, sequences and series, polynomials, graphing, simulations and games. A special review chapter is given for those whose knowledge of BASIC is limited or distant in time. The book is also intended for those who already know another programming language and want to pick up BASIC.
ORDER NO. 0-8104-5855-1 $10.75

The Computerization of Society
By Simon Nora and Alain Minc

First published in 1978 as a report to France's President, Valery Giscard D'Estain, this book became a best-seller abroad and the cause of instantaneous and widespread public discussion. It portrays a revolution, in some ways comparable to the Industrial Revolution, which is the result of the growing interconnection between computers and telecommunications.

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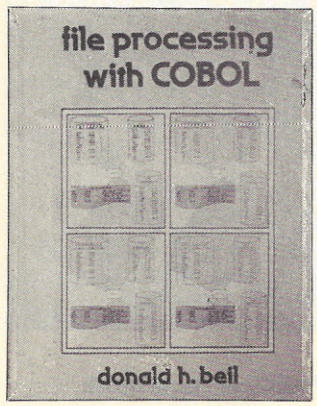

File Processing With COBOL
By Donald H. Beil

This book is designed for those who have an introductory knowledge of the COBOL language. Working on this foundation, you will learn how to create, merge, sort and update sequential and sequential indexed files in COBOL. You'll be impressed with unique flow charts at the systems level, and effective technique for presenting each concept quickly and easily. Two extensive case studies provide significant supplementary material, and show how to apply new skills. Each chapter concludes with a summary, plus programming and non-programming exercises to reinforce learned concepts.

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How To Troubleshoot and Repair Microcomputers
By John D. Lenk

Microcomputer and peripheral system repair will be simple for any advanced computer hobbyist or technician who has this book. Using circuits and systems found in one of today's leading microcomputers as typical examples, the author shows how to locate and repair the cause of trouble in any central system or peripheral or in any control system using a microprocessor.

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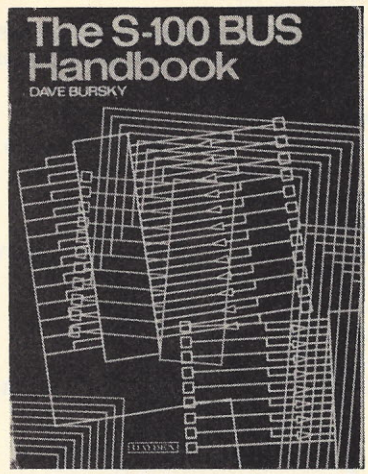

S-100 Bus Handbook
By David Bursky

Computer fundamentals, basic electronics and the parts of the computer are covered here. The book explains all the operating details of commonly available S-100 systems. Schematic drawings of all boards discussed in the manual are provided for reference. Each major system board is discussed in complete detail, as to how it operates and how it connects into the rest of the system.

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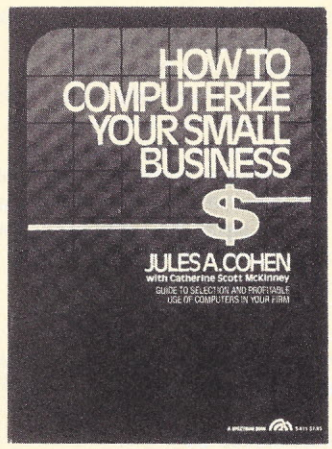


How To Computerize Your Small Business
By Jules A. Cohen

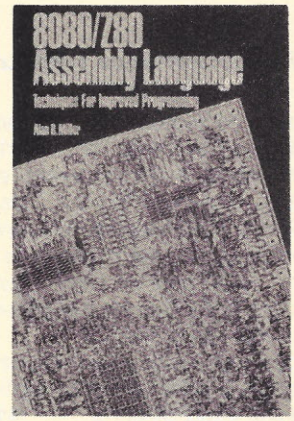
This is a complete step-by-step guide to selecting data processing equipment and services, and shows you how to plan a computer system tailored to the needs of your small business. It not only describes the basics of how a computer works, but also advantages and limitations of the most popular types of computer equipment.

ORDER NO. 0-13-403857-6 $7.95

Programmer's Guide to LISP
By Ken Tracton

This fact-filled handbook offers a simplified method of learning LISP, the best known language of artificial intelligence. The first part of the book follows a logical progression to guide you through the basics of algebraic functions, expressions, atoms, symbols, lists, sublists, and subexpressions. The last part of the book shows how to write complete LISP programs, and offers instructions on computer input and output.

ORDER NO. 0-8306-1045-6 $6.95



8080/Z-80 Assembly Language
By Alan Miller

For both intermediate and advanced programmers, this complete guide to programming the 8080 and Z-80 microprocessors lets you get every response your computer is capable of generating. Learn the details of assembly language programming easily and quickly—as you develop a powerful system monitor in a step-by-step, top-down approach. You'll start with number bases and logical operations, then move on to branching, rotation and shifting, one's and two's complement arithmetic, and stack operations. You'll find out how your assembly language programs can utilize the CP/M operating system for all input and output.

ORDER NO. 0-471-08124-8 $9.95

The Joy of Minis and Micros
By Philip Stein and Howard Shapiro

Here's a collection of pieces covering technical and management aspects of the use of small computers for business or science. It emphasizes the use of common sense and good systems design for every computer project. A strong technical background is unnecessary, which makes the book neither difficult to read nor to understand.

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Managing Software Development and Maintenance

By Carma L. McClure, Ph.D.

In this book, the author points out how to control rising software costs by the application of software engineering principles and methodologies to software maintenance, as well as to software development activities. The author shows you how to build the quality of maintainability into a software system during the development phase and how to preserve software quality during the operation and maintenance phase. System design methods emphasizing creating software that is easy to change is the key.

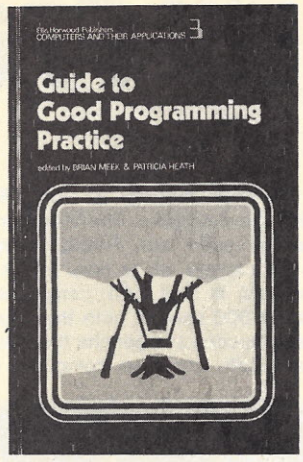
ORDER NO. 0-442-22569-5 $16.95

Apple II User's Guide

By Lon Poole, Martin McNiff and Steven Cook

It's all here in the new Apple II User's Guide. This guide will compliment your owner's manual and give your a heightened understanding of your Apple II. With this book you'll be able to program in BASIC. You'll be able to use the sound and graphics features of the Apple II to create your own colorful video games. There's also a review of the Apple II printer as well as a chapter on controlling "Real" processes, like burglar alarms and appliances.

ORDER NO. 0-931988-46-2 $15.00



Guide to Good Programming Practice

Edited by Brian Meek and Patricia Heath

This is the first book to bring together in a compact format, real guidance on the many aspects of a computer programmer's work. The book covers structural programming and program writing techniques. But it goes further by explaining much more than that. It covers analysis, design, testing, debugging, "Tuning" for better efficiency, copying with a computer's limitations, selecting a language, language standards, program documentation, taking on another programmer's work, and more.

ORDER NO. 0-470-26869-7 $32.95

Some Common BASIC Programs

By Lon Poole and Mary Borchers

This book contains program listings and documentations for 76 short programs covering financial, mathematical, statistical and general interest applications. Every program has been tested; examples and sample program runs are published with the source listings for each program.

ORDER NO. 0-931988-06-3 $14.99

Sargon: A Computer Chess Program

By Dan and Kathe Spracklen

Here is the computer chess program that won first place in the first chess tournament at the 1978 West Coast Computer Faire. It is written in Z-80 assembly language, using the TDL macro assembler. It comes complete with block diagram and sample printouts.

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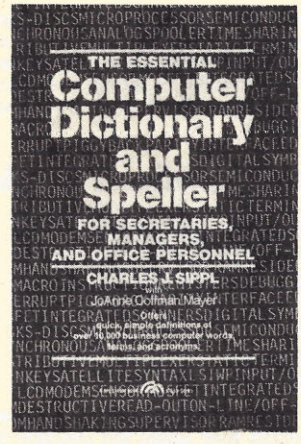


The Essential Computer Dictionary and Speller

By Charles J. Sippl

This book is for anyone whose job requires familiarity with computer or electronic words. This book provides a reliable, fingertip source of both spellings and meanings. Handy, business-oriented dictionary defines more than 15,000 computer terms and acronyms, simply and practically. More than 100 pictures, line drawings, and other figures assist in providing clarity and greater ease-of-use for browsing and learning.

ORDER NO. 0-13-284356-0 $6.95

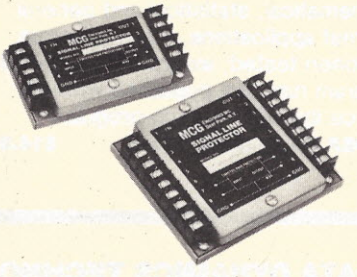
NEW PRODUCTS

Direct connect modem for the TRS-80 model III is now available. The Microconnection can be used with RS232 equipped models from level I, 4K to level II 48K disk systems and is Bell 103 compatible. It operates at 300 baud in both the originate and answer modes and permits the model III to communicate with other computers such

as The Source, CompuServe (MicroNet) and public access bulletin boards. The modem measures 7.7 in. wide by 5.5 in. deep by 1.7 in. high and weighs less than 1 pound. The price, including power supply and terminal program, is $199.50. Microperipheral Corp., 2643 151st Pl. N.E., Redmond, WA 98052, (206) 881-7544.

CIRCLE INQUIRY NO. 220

Signal line protectors provide complete interface protection for signal/data/telephone lines; they protect two-wire systems and RS232, RS423, RS422 systems. Models are available that can protect as few as two or up to a multitude of independent twisted pairs. Housed in compact low-profile cases, all protectors can be installed by simply using a



screwdriver. Applications include modems, computers, peripheral equipment, semiconductor devices, as well as all other sensitive equipment that interfaces directly with telephone or signal lines. Price: $59 and up. MCG, 160 Brook Ave., Deer Park, NY 11729, (516) 586-5125.

CIRCLE INQUIRY NO. 221

Accounts receivable package was developed for use on 8080 based or related computer equipment using the CP/M or similar operating systems such as EDOS, CDOS, IMDOS, RT-11, ISIS 11 and TIUCSD. Written in Interactive CIS Cobol, it is supplied in directly executable machine code. The system is completely menu-driven to facilitate operations. A step-by-step instruction manual is also included. The package provides for both open-item and balance-forward type accounting methods. It features complete customer file maintenance, on-line customer account inquiry, interactive invoice, cash and adjustments entry, complete audit-trail facilities and optional calculation of interest on overdue accounts. "Total receivables to date" position can be calculated and displayed immediately. User options include date format, aging frequency, general ledger interface, order entry interface and dunning letters. Operator is notified by program of errors due to incorrect data entry. Reports generated include sales and cash transaction proof, sales and cash journal, monthly sales and cash summaries, sequential and alphabetical customer lists, sales analysis reports by customer number and type, salesman's number and territory, statements of account, interest charges journal, aging reports by customer and transaction date and transaction summaries for sales, cash and adjustments. RPW Systems and Services Inc., 47 Fundy, P.O. Box 588, Pl. Bonaventure, Montreal, Quebec H5A 1C5.

CIRCLE INQUIRY NO. 222

Battery-operated terminal, Alpha-Tone, with a 40-key alpha-numeric keypad can be acoustically coupled to any telephone handset. The terminal makes Touch-Tone data entry systems practical for applications such as order entry and order confirmation for industries with alphabetic characters in their item numbers. Examples of these industries

include automotive parts, appliance and appliance parts, business supplies, apparel, electrical and electronic equipment and parts, and many others. Price: under $250. Interface Technology, Inc., P.O. Box 21558, 10500 Kahlmeyer Dr., St. Louis, MO 63132, (314) 426-6880.

CIRCLE INQUIRY NO. 223

Mathematical program, Fractional Sound, uses special 2-in. and ⅝-in. numeric characters to display fractions the way they are normally written. The teacher or parent can set seven parameters to tailor the program to the student. These are: type of operation (add, subtract, add or subtract, multiply, divide, multiply or divide, all 4); size of numerators (1 or 2 digits); size of denominator (2 through 40); number of students (1 through 40); whether mixed fractions will be used, and whether this is a test. If the test mode is selected, the program can generate the problems, display them (with the answer),

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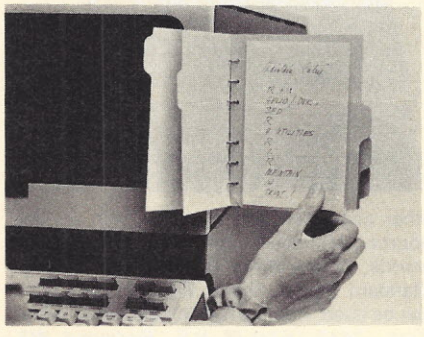
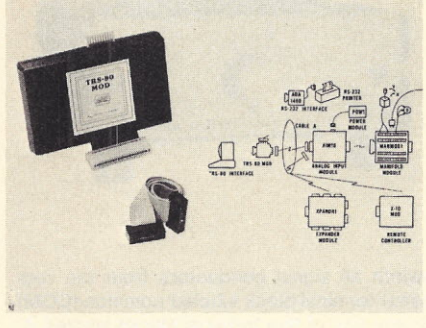
and get your approval; or, you can input the problems. The program then presents identical problems to all students. If you did not select the test mode, the program uses random problems. If the student gets a problem wrong, the program works the problem, step-by-step on the screen, and waits for the student before continuing. The program features a self-relocating imbedded machine language sound routine, and high-speed graphics, and introduces Marley Mole. This fraction drill program was designed for grades 4 through 10 and requires 15K bytes of RAM. Price: $18.95. Innovative Penguin, 2320 Hampton Dr., Harvey, LA 70058.
CIRCLE INQUIRY NO. 224

Program notes can be contained in a small log that mounts vertically or horizontally on CRTs, POS or ECR terminals. The Menu-Minder can be affixed permanently with pressure-sensitive tape or can be mounted with Velcro strips so the log can be switched among terminals. Twenty reference cards in



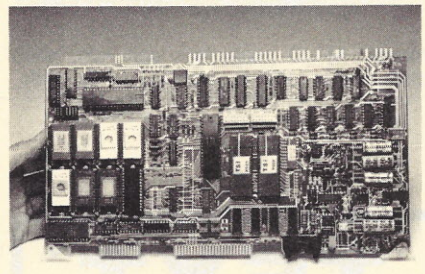
protective plastic sleeves and colored index dividers are free-turning on a ring assembly mounted on an L-shaped base. Reference cards are ruled to match the direction in which the log is mounted. Overall size is 6½ by 5½ in. to fit on the side of terminals or to mount on keyboard decks. Devoke Data Products, 3780 Fabian Way, Palo Alto, CA 94303.
CIRCLE INQUIRY NO. 225

Input interface for TRS-80 microcomputers allows the same low cost data acquisition and control previously available for Pet, Apple, and other popular computers. The TRS-80 mod plugs into the expansion port or



printer port to allow the reading of temperature, light levels, pressure, and voltages, plus the remote control of lamps, motors, pumps, heaters, appliances, communications devices, alarms, and similar equipment. The basic purpose is to generate a microMAC bus from the computer. It contains an 8-bit latch, an 8-bit tri-state buffer, and the necessary decoding logic. OUT and INP Basic statements access the modules, including the analog input module and the X10 remote controller with electronic clock and calendar, plugged into the μMAC bus. Price: $59.50. TRS-80 Mod, Connecticut Microcomputer, 34 Del Mar Dr., Brookfield, CT 06804.
CIRCLE INQUIRY NO. 226

Synthesizer board, Speech 1000, features large vocabulary capacity, superior speech fidelity and three-way interfacing flexibility. Targeted for OEMs, system integrators and sophisticated end-users in the industrial and commerical markets, the board allows its users to employ a state-of-the-art speech synthesis system for a variety of applications. The board is easily interfaced to almost any computer, giving system designers maximum

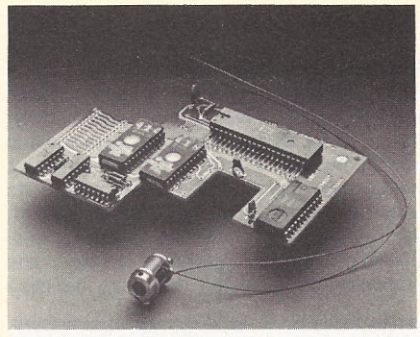


flexibility. It offers Multibus system users plug-in compatibility. Other micro or minicomputers can interface to the Speech 1000 through the board's TTL parallel port or its RS-232C serial port. The system offers significant benefits to applications where machines provide status, alarm and instructional information to man. Price: $1,200. Telesensory Speech Systems, 3408 Hillview Ave., Palo Alto, CA 94304, (415) 856-8255.
CIRCLE INQUIRY NO. 227

Operating system package for the 6502 family of processors is available on an 8-in. soft sectored, IBM compatible diskette. DOS/65 has been designed to provide features similar to those available under the CP/M operating system for the 8080/Z80. It uses a layered structure like CP/M so that each user's peculiar hardware and software environment can be accommodated with minimal effort. Thus while the package is currently available configured only for the Tarbell controller interfaced to the 6502 through a KIMSI, BETSI, or other S-100 interface, the accompanying documentation will allow the purchaser to modify the operating system software for his system. Data is also included for those who wish to tackle the 6502 to Tarbell controller interfacing job. In any case the only firm device requirements are: 8-in. IBM compatible drive and controller; console input device; console output device. In addition to the basic operating system the distribution diskette contains a powerful disk file test editor; a disk based, two-pass assembler; a debugger; a system generation routine and a number of other transient utilities. Routines are also included which show how to modify Pittman Tiny Basic and a RAM based version of Microsoft Basic for DOS/65 including SAVE and LOAD of programs. DOS/65 requires a minimum of approximately 16K of user RAM and is available with several transient starting addresses ranging from $200 to $2,000 for compatibility with AIM, SYM, KIM, TIM, OSI, Pet, and Apple memory allocations. Price: $100-$150; documenta-

tion $30. Richard A. Leary, 1363 Nathan Hale Dr., Phoenixville, PA 19460.
CIRCLE INQUIRY NO. 228

Modification unit turns the standard 80 column TI 743/745 or 763/765 into a 136 column portable terminal, giving 70% more data in the same space. Two steps are required: the simple replacement of the socketed microprocessor with a small printed circuit board; and changing the motor pulley and cable. These changes are fully reversible, permitting the terminal to be reconfigured as original. Needing only a small screwdriver for installation, the TXP 136 enhancement operates via the TI terminal on standard 8½-in. paper width. Either 80 or 136 column operation is selectable from the keyboard or remote computer. In addition to providing 136 columns of print positions, the unit presents output in much more readable form. 80 column printing on the unmodified TI terminal is in a 35-dot matrix, 5-in. by 7-in.

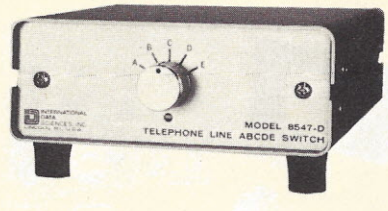


format. At 10 characters per inch, each character is .105 in. high by .08 in. wide. This contrasts with the modified version, which in the same 35-dot matrix and 5 by 7 format presents letters the same height—but only .048 in. wide. Therefore, 18 characters per inch are printed, producing remarkable clarity and easy readability in a portable terminal. Price: $375. Texprint, Inc., 8 Blanchard Rd., Burlington, MA 01803, (617) 273-3384.
CIRCLE INQUIRY NO. 230

Direct connect modem connects to the Radio Shack TRS-80 color computer. It works with a 4K system and extended Basic is not required. The modem is Bell 103 compatible and operates in both the originate and answer mode at 300 baud. The unit will interface the color computer with public telephone networks. It permits accessing

other computers and systems such as The Source, MicroNet, public access bulletin boards, or any other time sharing system. Standard Radio Shack Videotex software can be used. Price: $199.50. Microperipheral Corp., 2643 151st Pl. N.E., Redmond, WA 98052, (206) 881-7544.
CIRCLE INQUIRY NO. 229

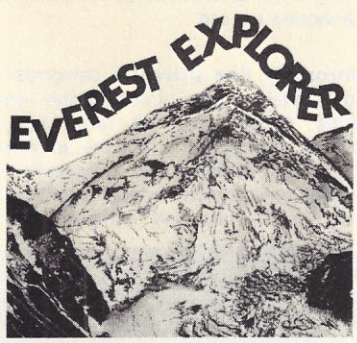
Telephone line switch with five channels allows the user to manually switch any four-wire analog input to any one of five four-wire outputs. For use with TTY data links, the unit can also be used for two-wire switching. The model 8547 is available in either desktop or rack mount configurations. The module contains a five position rotary switch on the front panel which allows the operator to



switch all signal conductors from the rear panel terminal block labeled common (COM) to any one of five terminal blocks labeled A, B, C, D, or E. All connections for the unit are made at the rear panel by means of six four-screw terminal blocks. No power is required. Price: $355. International Data Sciences, Inc., 7 Wellington Rd., Lincoln, RI 02865, (401) 333-6200.
CIRCLE INQUIRY NO. 231

Simulation game, Everest Explorer, is available for TRS-80 model I level II, 16K on tape. Assigned an expedition budget, the player must select manpower, food, fuel, shelter

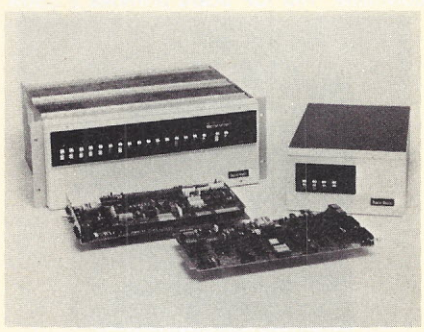
and oxygen supplies needed to support the climb. Weather conditions, choice of route,



climbers' condition and morale all play key roles. Price: $14.95. The 32K disk version, including save game option and other enhancements is $20.95. Acorn Software Products Inc., 634 N. Carolina Ave. SE, Washington, D.C. 20003, (202) 544-4259.
CIRCLE INQUIRY NO. 232

Smart terminal program, SmartIII, is written for the TRS-80 model III. The program is available on either a 1500 baud cassette or double density disk. It permits transfer of Basic programs between the host computer and the cassette or disk storage device. The program permits off-line text preparation (messages, manuscripts, letters, etc.) with Electric Pencil or Scripsit for on-line transmission. An additional program called File permits generation and storage of text, then transmission by SmartIII for those who do not have word processors. It can be used with any RS-232 compatible modem such as the RS232Connection, a direct connect telephone interface. Price: $99.50. Micro-Peripheral Corp., 2643 151st Place N.E., Redmond, WA 98052, (206) 881-7544.
CIRCLE INQUIRY NO. 233

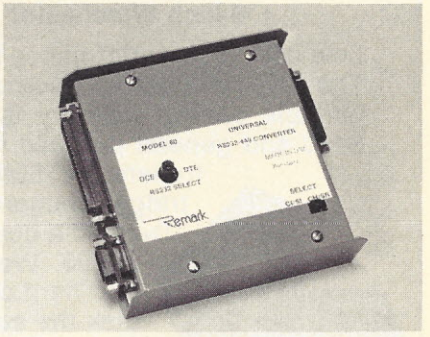
Originate/answer triple modem with Multi-line automatic dialing capability is specifically designed for central computer sites and can automatically originate calls to, and answer calls from, the three popular types of remote modems: Racal-Vadic's VA3400 series, Bell's 212A, and the Bell 103/113 series. The VA33480 triple modem replaces eight different Bell type modems: the 103A/E/J; the 113A/B/C/D; and the 212A, without altering hardware, software or changing dial-up disciplines. It can also communicate with all versions of Racal-Vadic's VA3400 series



of 1200 bps full duplex modems. The modem can automaticaly call any VA3400, 212A, or 103/113 type modem with the central computer maintaining complete control of the calling operation, including the selection of low and high speed calling modes. When originating a call in the high speed mode, it has a unique detection system

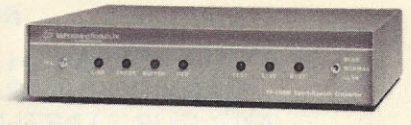
which instantly determines whether the remote answering modem is a VA3400 or a 212A, and automatically configures itself accordingly. Racal-Vadic, 222 Caspian Dr., Sunnyvale, CA 94086, (408) 744-0810.
CIRCLE INQUIRY NO. 234

Interface converter allows coupling of RS-232C based equipment with devices employing the new industry standard RS-449. The interface requirements are very different depending on whether the RS-232C devices are considered DTE or DCE. The model 60



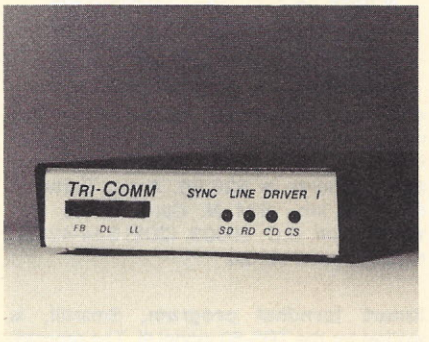
Universal RS-232/RS-449 Converter incorporates the switching facility to allow the user to select the RS-232 as a DCE or DTE. Support of reverse channel for the RS-449 is provided by the required separate 9-pin male connector. The RS-232 port has a 25-pin female connector while the RS-449 port has a 37-pin male connector. The model is compatible with the Dataphone II modems from Western Electric and other modems from various manufacturers and is in full compliance with the EIA Industrial Electronics Bulletin No. 12, *Application Notes on Interconnection Between Interface Circuits Using RS-449 and RS-232-C.* Price: from $115. Remark International, 4 Sycamore Dr., Woodbury, NY 11797, (516) 367-3806.
CIRCLE INQUIRY NO. 235

Synch/asynch converter allows asynchronous data terminals to operate on a synchronous data link. The TP-200M accepts data in an asynchronous format and converts it for operation with a synchronous modem. It also matches the data rate of the terminal to the modem regardless of the relative speed of the devices. In networks using asynchronous modems, it may be used for speed-matching and error-correcting alone. Provisions have been made for the use of



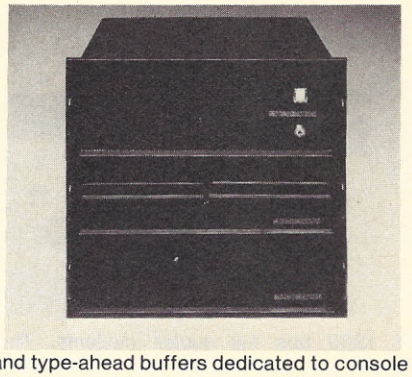
X-ON, X-OFF signals to prevent buffer overrun during periods of excessive line hits. The converter allows a network of unintelligent terminals to be arranged in a multidrop configuration resulting in significant coast savings. If combined with synchronous modems, a substantial increase in network reliability and throughput is possible. It also has remote test capability and remote reading of operating parameters. TeleProcessing Products, Inc., 4565 E. Industrial St., Building 7K, Simi Valley, CA 93063, (805) 522-8149.
CIRCLE INQUIRY NO. 236

Synchronous line driver is designed to provide reliable data transmission over unloaded twisted pair at rates up to 19.2K bps. The SLD-1 offers the additional unique feature of being able to operate in a multi-point environment, which significantly reduces cable runs and computer ports



required by limited distance, point-to-point modems. The driver also uses an internal crystal control oscillator to control clock rates and a scrambler, which guarantees long-term stability over the transmission link. Clock recovery is also accomplished with a digital phase lock loop, which does not require any adjustment as the data rate is changed. It provides complete diagnostics, including status indicators, which display all operating conditions, and both line and digital loop backs. The rack mount version will accommodate up to 16 line drivers in a single rack mount unit. Transmission rates are switch selectable from 1200 baud synchronous to 19.2 synchronous. Front panel selection of fall back data rates for either ¾ or ½ speed is also included as a standard feature. Tri-Communications Industries, Inc., 20 Fitch St., E. Norwalk, CT 06885.
CIRCLE INQUIRY NO. 237

Intelligent console processor board relieves the master processor of the bulk of its console I/O responsibilities. The modularity and versatility of the system are retained with self-contained expansion boards. A single-user system is upgraded by simply installing a satellite CPU/RAM card for each additional station desired. The upgrade can be accomplished on location, with minimal downtime. The ICP board provides a Z80A



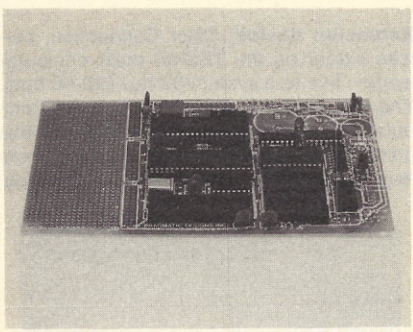
and type-ahead buffers dedicated to console I/O. The card also features serial ports for all eight terminals, with a data exchange rate of up to 19.2K baud. The M/NET system is configured to allow a master with a Z80A and 64K of RAM to execute the operating system, while a separate satellite card is

alloted to each user. Price: $5,500 for the single user module. Micromation, Inc., 1620 Montgomery St., San Francisco, CA 94111, (415) 398-0289.
CIRCLE INQUIRY NO. 238

Word processing/computer ribbon cartridge is a version of the N.E.C. multistrike unit which is used on Japanese N.E.C. printers. The ribbon is injection molded, assembled, and packaged in the U.S. Aspen Ribbons, 1700 N. 55th St., Boulder, CO 80301, (303) 444-4054.
CIRCLE INQUIRY NO. 239

Variable cross reference disk is compatible with the TCS version 5 update of the CP/M business accounting package as well as the current version, Microsoft Basic 4.5. Available for both the interpretive and compiled versions, the disks contains a complete sorted listing of all variables and keyboards used in each program and on which lines they are referenced. TCS Corp., P.O. Box 47550, Atlanta, GA 30362, (404) 455-6162.
CIRCLE INQUIRY NO. 240

Single board computer, CPU-1, is an 8085 based micro similar to the Intel 80/04 board. Designed specifically for dedicated control applications, it allows designers to concentrate on their overall application, rather than on detailed design by providing the basic microcomputer circuitry, support logic and even the power supply on board. The sytem operates at 3 MHz and includes 256 bytes of RAM, 22 I/O lines, one serial port, one programmable counter/timer and two sockets for 1-4K bytes of EPROM. The system has both power on reset and a



manual reset button, and the 8085's vectored interrupt structure supported. The system power supply rectifiers, filters and regulators are on the P.C. board so that only an external transformer is needed to complete a one board system. Applications programs can be developed using any 8080/8085 development system. Pragmatic Designs, Inc., 950 Benicia Ave., Sunnyvale, CA 94086, (408) 736-8670.
CIRCLE INQUIRY NO. 241

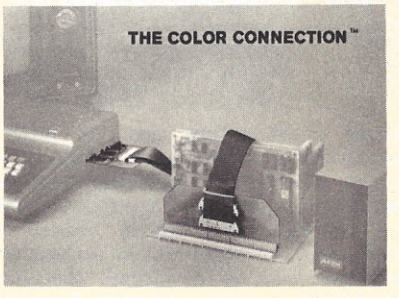
Microcomputer system is designed for applications in the laboratory. When used with an Apple II+ computer, the APPLAB system can be used to control or collect data from most scientific instruments, such as spectrophotometers, chromatography systems, pH meters, strip chart recorders and temperature controllers. The hardware interface features 12-bit digital to analog and analog to digital converters with jumper-selectable ranges of ±0.5V, ±1.0V, ±2.0V and ±4.0Volts. The dual-slope integrating A/D converter smoothes out noisy signals at up to 20 voltage readings per second. True

differential input and automatic zeroing enhance the A/D accuracy. The digital I/O subsystem features 8 bits each of input and output, versatile handshaking signals, interrupt circuitry and TTL-compatible signal levels. A program called QUICKI/O is included with each interface card. It makes it easy to write programs in Basic to control the scientific instruments. Package price: $495. Interactive Microware, Inc., P.O. Box 771, State College, PA 16801, (814) 238-8294.
CIRCLE INQUIRY NO. 243

Desk for data features an open shelf configuration to accommodate component board systems, electronic systems, peripherals, microprocessors and other electronic equipment not conforming to RETMA specifica-

tions. Each desk has three sets of 14-guage steel angle brackets, adjustable top to bottom. The Specialty 8 DataDesk's dimensions are 26 in. high, 32 in. deep, and 48 in. wide. Systems Furniture, 2727 Maricopa St., Torrance, CA 90503, (213) 533-1212.
CIRCLE INQUIRY NO. 242

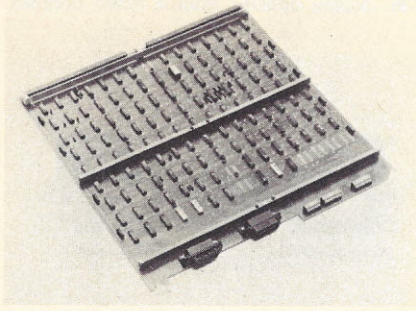
Extension device, Color Connection, permits extending the TRS-80 color computer system bus as a system-50 bus (SS-50 bus). The unit allows a user to expand the computer into a serious machine. The SS-50 bus compatible modules of other manufacturers may be used in system expansion. The con-



nection consists of a flat ribbon extension cable with interfacing PC cards at each end. One end plugs into the Program Pak socket of the Color Computer and the other end plugs into a System-50 motherboard, which is not included. Price: $99.95. Percom Data Co., 211 N. Kirby, Garland, TX 75042, (214) 272-3421.
CIRCLE INQUIRY NO. 244

Bus controller for Perkin-Elmer (Interdata) computers allows the computer to control programmable instruments, both talker and listener devices. Also included are computer oriented peripheral devices that are configured for the IEEE 488 bus. A full capability controller (C1-C5), the MDB board generates parallel and serial polls, extends control to

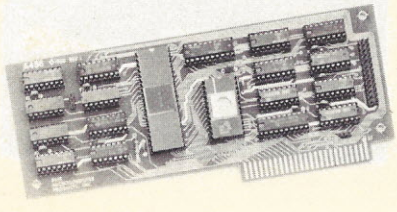
other intelligent devices and when switch enabled, acts as the system controller.



Among its capabilities are a talker function (T5 and TE5), a listener function (L3 and LE3), service request (SR1), remote/local (RL1 or RL2) and parallel poll (PP2). The interface communicates with the computer via the multiplexor and selector channel I/O bus. The interface is contained on a single 15 by 15 in. board. Price: $1,250. MDB Systems, Inc., 1995 N. Batavia St., Orange, CA 92665, (714)998-6900.

CIRCLE INQUIRY NO. 245

Interface card for Apple II and Apple II Plus computers permits operation as 488-bus controllers. It is designated the A488, and offers a low cost alternative to the purchase of a specially designed bus controller; supplied by several instrumentation firms, such controllers are typically multi-thousand-dollar pieces of equipment. The card's small, Apple-compatible size is due to the use of Motorola's 68488—an LSI 488-controller circuit that decreases the number of IC packages required and the software overhead. The bus also carries 2K bytes of firm-



ware in EPROM, which runs the board itself. Software needed is written in Apple's own Applesoft Basic. The amount of user-programming required in minimal, and is focused directly upon the measurement problem at hand—not upon the mechanics of program design. SSM Microcomputer Products Inc., 2190 Paragon Dr., San Jose, CA 95131, (408) 946-7400.

CIRCLE INQUIRY NO. 246

Video extender cable for TRS-80 model I allows you to position your video monitor at a place not necessarily beside your keyboard. Available in 3 ft. and 6 ft. lengths. It can be used for classrooms, exhibits, meetings, displays and demonstrations. Prices: 3 ft.—$20; 6 ft.—$24. E.B.G. & Assoc., 203 N. Wabash, Suite 1510, Chicago, IL 60601, (312) 782-9750.

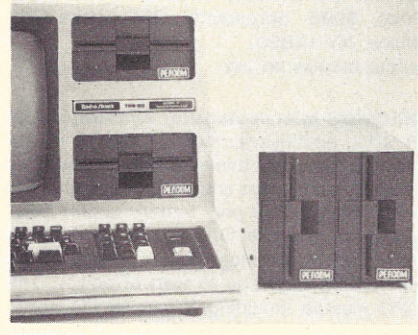
CIRCLE INQUIRY NO. 248

Graphic tablet is now directly compatible with Pet computers. The output directly matches the capabilities of this small computer, thus putting both interface and software requirements at a minimum. A special feature is that hard copy verification is simplified because a standard 8½ in. by 11 in. pad of paper fits exactly onto the tablet's surface. Resolution: 100/200 points per inch; conversion rate: 100

coordinate pairs per second. The tablet is 13 in. wide by 15.3 in. high by 0.75 in. thick. Kurta Corp., 206 S. River Dr., Tempe, AZ, 85281, (602) 968-8709.

CIRCLE INQUIRY NO. 249

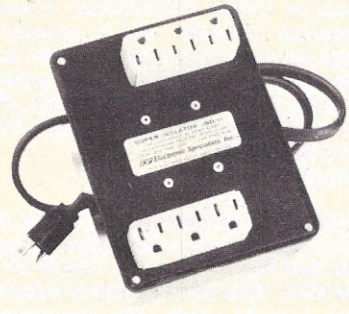
Mini-disk storage systems (5¼ in.) for the TRS-80 model III computer can be obtained with either 40- or 80-track drives that are rated for both single and double-density operation. Using Percom drives, a TRS-80 model III owner can expand his computer



with from one to four drives, adding from 102K bytes to almost 1.5M bytes of on-line formatted storage capacity. Both drive models are capable of "flippy" operation, so that diskette storage can be twice the on-line capacity. Percom Data Co., 211 N. Kirby, Garland, TX 75042, (214) 272-3421.

CIRCLE INQUIRY NO. 247

Isolating device curbs severe electrical problems. The model ISO-11 features two individually dual-Pi filtered AC socket banks (6 sockets total). Heavy-duty spike/surge suppression is incorporated in the design. Equipment interactions are eliminated and



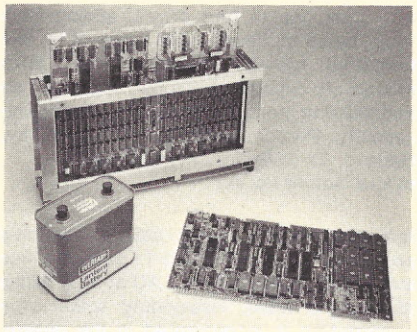
disruptive/damaging line spikes and hash are controlled. The device controls power line

spikes and hash while providing interaction free microprocessor operation. Price: $94.95. Electronic Specialists, Inc., 171 S. Main St., Natick, MA 01760, (617) 655-1532.
CIRCLE INQUIRY NO. 250

Winchester disk at 5¼ in. is compact enough to fit easily into many uses, especially small business systems, intelligent terminals, home computers and word processing applications. Low voltage requirements and the high reliability of 11,000 power-on-hours mean-time-between-failures makes the small disk useful for systems integration. Price: $1,490. Texas Instruments, P.O. Box 202145 H-574, Dallas, TX 75220, (713) 373-1050.
CIRCLE INQUIRY NO. 251

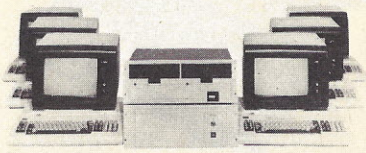
Client billing package, Series III, is a time-keeping billing and management package designed for professional offices. Developed to handle the complex billing structure used by lawyers, consultants, accountants and other professionals, it calculates receivables based on user-defined retainer fees, standard rates and services, time units, and disbursements. It also generates management reports gauging productivity and profitability of services performed. The first release is compatible with all microcomputers operating under CP/M or an equivalent operating system, and word processors supporting similar implementations. All of the customizing features required to tailor capabilities to an individual firm's present receivables system are available directly to the user. Price: $995. Serendipity, 225 Elmira Rd., Ithaca, NY 14850.
CIRCLE INQUIRY NO. 252

All-CMOS microcomputer system, model PPS-12, employs an IM6100 CMOS microprocessor and has been specifically designed for data acquisition and control applications in the field where only battery and/or solar power are available. Only 5 volts are required for operation, and most system configurations will require less than ½ watt of power. The CPU module including 3 parallel I/O ports,



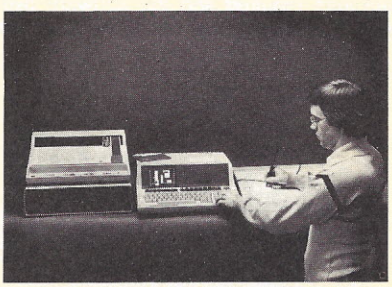
one optically-isolated 20 mA/RS-232 serial I/O port, a programmable real-time clock, 4K words of CMOS EPROM/RAM, a memory expansion controller and a powerful on-board transparent monitor/debugger, is also supported by over a dozen system expansion modules. Price: $999. Ted Netoff, PC/M, Inc., 6800 Sierra Ct., Dublin, CA 94566, (415) 829-8700.
CIRCLE INQUIRY NO. 253

Multi-user microcomputer, model 6500, utilizes a unique multiprocessor architecture with 8-bit microprocessors. This S-100 bus and CP/M compatible system is expandable from 1 to 64 users. The mainframe can accommodate up to 12 users and additional enclosures of up to 18 users each can be added. Each mainframe consists of the user processors (UP) and a master processor. Types of disk storage available include two 8-in. double density, double sided floppies



(standard), and optional 29 and 96M-byte hard disk subsystems. Prices start at $5,715. OSM Computer Corp., 2364 Walsh Ave., Santa Clara, CA 95051, (408) 496-6910.
CIRCLE INQUIRY NO. 271

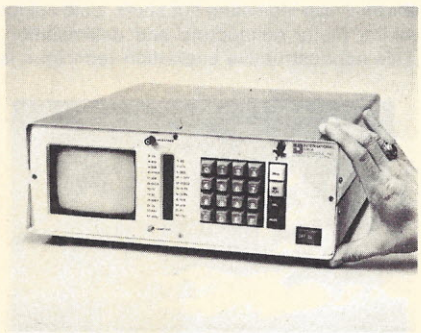
Graphics tablet for easy creation and manipulation of graphics on the display is incorporated in personal graphics system. Drawing schematics, floor plans, overhead transparencies, and digitizing existing graphics is made simple with the introduction of the software pac for the HP 9111 Graphics Tablet. Software that comes with the tablet gives it powerful, easy-to-use capabilities in three main areas: tracing and digitizing existing designs or logos; creating new designs; measuring areas and lengths of lines directly off maps or charts. Existing graphics, such as logos, maps, photos, and strip charts



may be converted to digital form using the tablet. The use may analyze digitized data using the HP series 80 statistics pac and plot out the results on an HP 7225B graphics plotter. Price: $2,050. Hewlett-Packard, 1501 Page Mill Rd., Palo Alto, CA 94304, (415) 857-1501.
CIRCLE INQUIRY NO. 254

Data communications test set which is portable and diagnostic, is designed to monitor and interactively communicate with data appearing at the EIA RS-232 interface. Data traffic is displayed on an easy-to-read, 5-in., 512 character CRT display. Sophisticated interactive and monitoring capabilities are accessible through menu pages displaying instrument configuration status to guide the user through all fault analysis procedures. The microprocessor-based Hawk 4010 quickly locates and isolates problems in the hardware and software by simultaneously displaying both transmit and receive data. The operator can program it to trap and store 4096 characters and recall this data for further detailed visual analysis. Thus,

problems caused by transmission errors, equipment malfunctions, or inherent software problems can be effectively analyzed and corrected. The device operates with synchronous data rates up to 19,200 bps in both half and full-duplex modes. Asynchronous operation is provided by sixteen internally generated clock speeds ranging from 50 to 19,200 bps. Data characters can contain 5, 6, 7, or 8 bits, with 1 or 2 sync characters, plus parity. Standard protocols include: BISYNC, SDLC (NRZ, NRZI), HDLC,



X.25, and all standard ADCCP. ASCII, Baudot, EBCD, EBCDIC, HEX, IPARS, OCTAL, Selectric, and Transcode formats are also standard. These combined features make the Hawk 4010 compatible with virtually any data communications system, without requiring expensive optional features. Price: $5,500. International Data Sciences, Inc., 7 Wellington Rd., Lincoln, RI 02865, (401) 333-6200.

CIRCLE INQUIRY NO. 256

Storage cases, the Data Vault line, are available in models to accommodate magnetic tape reels and disc cartridges as well as floppy discs. They are custom-molded cases

built to protect valuable software from the hazards of shipping and handling. PRC Computer Products, 46 Passaic St., Bldg. 52, Wood Ridge, NJ 07075, (201) 933-9125.

CIRCLE INQUIRY NO. 255

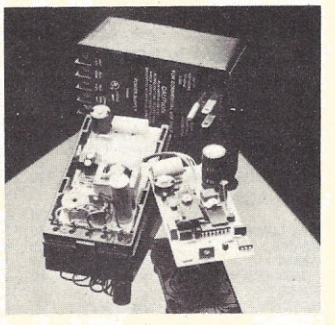
Microcomputer system features a 5M-byte micro-Winchester hard disk for storage of system programs and data, plus a 900K-byte double-sided GCR minifloppy drive for I/O and backup. This provides high capacity, fast access, low cost storage with quick and easy backup capabilities. Standard CP/3 features include: Z-80 microprocessor, 64K of RAM (standard), a 1920 character CRT with anti-glare amber screen, serial communications channel and a Centronics-compatible parallel printer interface, all packaged in a white hammertone finish cabinet. System options include up to two additional 5M-byte micro-Winchester disk drives in their own cabinet and a selection of dot matrix and daisy wheel printers. The System X is

CIRCLE INQUIRY NO. 92

supported by the CP/M operating system, with Microsoft Basic (interpreter and compiler), Fortran and Cobol available, as well as the Wordstar word processing system. Price:

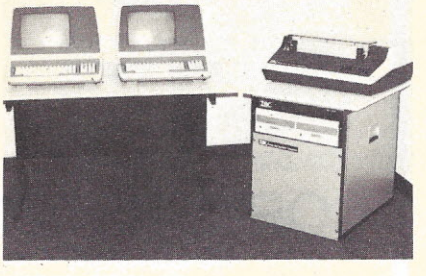
starts at $7,200. Commercial Computer, Inc., 7884 12th Ave. So., Minneapolis, MN 55420, (612) 854-2309.
CIRCLE INQUIRY NO. 258

Plug-in power supplies deliver up to 25 watts of regulated DC power. Two versions are offered for microprocessor-based systems: one, a single output (+5 volts at 5 amperes); the other, a triple output (+5



volts at 2.5 amperes and ±12 volts at 0.2 amperes). Additionally, for telephone applications there is a single-output unit giving 48 volts at 0.5 amperes. Ault, Inc., 1600H Freeway Blvd., Minneapolis, MN 55430.
CIRCLE INQUIRY NO. 257

Z-80 based computer will offer an upgrade path to both dealers and end users who need a larger, more powerful system yet want to keep their library of Z-80 based software intact. Features of the ENSIGN are as follows: up to 16 CRT/printers can be supported; 64K to 768K-byte memory, bank selectable at any size from 4K to 64K/bank; 6 MHz Z-80B CPU; 14, 42, 70, and 150M-byte Winchester disk drives; both 17M-byte tape



cartridge and 9 track reel-to-reel tape drive; slave twin Z-80s to handle all serial I/O with 2K-byte buffer/serial I/O port (32K-byte total; a third slave Z-80 to handle all disk/tape I/O and an advanced DMA controller that allows data transfer to any memory whether selected by main CPU or not.) This allows very heavy disk I/O without degrading main CPU throughput. Price: from $7,000. Integrated Business Computers, 22010 S. Wilmington Ave., Carson, CA 90745.
CIRCLE INQUIRY NO. 259

Troubleshooting for electronic circuitry can be done by using temperature-sensitive cholesteric liquid crystals to provide a color thermal map indicating hot spots, cold solder joints, faulty connectors and delamination. This nondestructive evaluation technique is

useful for a number of electronic devices including microcircuits, transistors, power semi-conductors, microwave antennas and lines, electrical wiring and other electronic applications. Downtime for computers and other important apparatus can be reduced since liquid crystals can provide an early indication of temperature changes which may lead to problems. Djinnii Industries, 153 Helena St., Dayton, OH 45404.
CIRCLE INQUIRY NO. 260

Headcleaning disks, FlexyDisks, clean read/write heads on diskette drives without the disadvantages of chemical solvents or liquids. The diskettes, available in both 5¼-in. and 8-in. sizes, are for use on single-sided flexible disk drives only. Cushioned cleaning material

cleans drive heads without risk of damage to drive from cleaning fluid. Simply insert into disk drive and activate for about 60 seconds. Check-off boxes on the label help keep track of diskette use. Package of three: $45. BASF Systems Corp., Crosby Dr., Bedford, MA 01730, (617) 271-4000.
CIRCLE INQUIRY NO. 261

Intelligent keyboard, the Cortron CP-4550, features serial output, N-Key rollover, automatic repeat and custom codes. The CP-4550 keyswitch provides an exceptional, true linear feel. It is also environmentally superior to foam pad design approaches. The keyswitch carries a life cycle test rating in excess of 100 million cycles. In

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64K 1 Drive
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26-4162 3 Drive Exp.....2114.00
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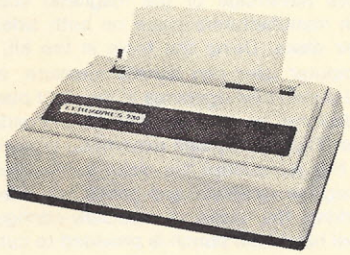
26-4512 Profile II.....162.00
26-4511 Visicalc II.....265.00
26-4501 Gen Ledger.....180.00
26-4506 Mail List.....72.00

PRINTERS



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26-1158 Daisy Wheel II.....1799.00
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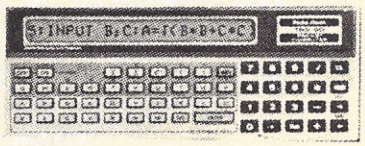
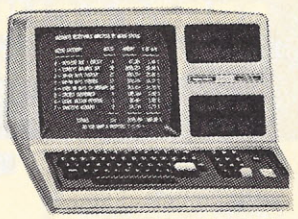


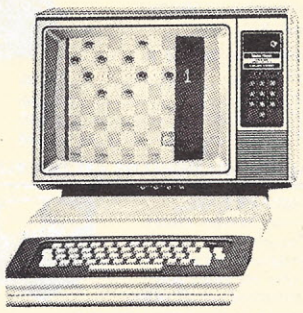
26-3501 1.9K P.C.....$221.00
26-3503 Cassette IF.....45.00
14-812 Recorder.....72.00

MODEL III



26-1061 4K I.....$629.00
26-1062 16K III.....865.00
26-1063 32K III
W/2 Drives, RS232.....2225.00

COLOR



26-3001 4K.....$353.00
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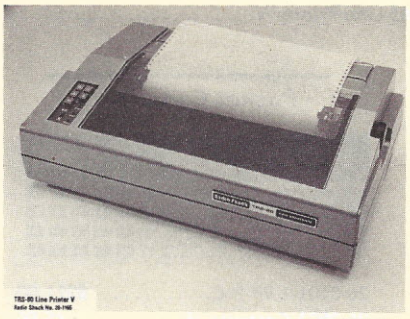
addition, the keyswitch utilizes the full line of Cortron keytops. The keyboard is 100%

tested and carries a full 2 year warranty. Cortron, 400 W. Grand Ave., Elmhurst, IL 60126, (312) 279-9110.
CIRCLE INQUIRY NO. 262

Data processing system is designed specifically for funeral homes. In addition to general ledger and accounts receivable software, the system has word processing and historical record keeping capabilities. The program for the TRS-80 model II is 64K dual drive and 132 column printer. It programs in model II Basic Rev. 1.2 under TRSDOS version 2.0a. FSCS, #5 McLean Ln., Springfield, IL 62704, (217) 544-7428.
CIRCLE INQUIRY NO. 263

Line printer, model V, for TRS-80 has bidirectional, logic-seeking dot-matrix head that prints high-quality 7 by 9 upper and lower case characters (with descenders) 132 columns wide. It features software selectable 5, 7.5, 10 or 15 characters per inch. 26 European characters and 30 graphics patterns. And print speed is given as 160 characters per second, 60 lines per minute. The tractor feed mechanism is adjustable to handle any fanfold computer paper up to 15



in. wide and up to 5 sheets. It is adjustable in 1/8-line increments for accurate positioning of preprinted forms. The printer has indicators for Ready, Power and Alert (paper out), plus five pushbutton controls including self-test. Price: $1,860. Radio Shack, 1800 One Tandy Center, Fort Worth, TX 76102, (817) 390-3272.
CIRCLE INQUIRY NO. 264

Video text editor, MINCE, is based on Emacs text editor available on large minicomputer systems. The program can edit several files simultaneously. Text can be moved between files and the screen can be split to display any two of them. Text can be manipulated by the word, sentence or paragraph as well as character, line and entire screen. There are many unique features such as commands to change words to uppercase, lowercase or capitalize. Deleted text is saved and can be restored. Global replace results can be "tried out" and then accepted or rejected. It is written in the C programming language and offers an upward compatible path from 8080/Z80 micros to 16-bit micros and minicomputers. It works on the North Star, TRS-80 model II and other computers that have CP/M-compatible operating systems. Price: $125. Westico, Inc., 25 Van Zant St., Norwalk, CT 06855, (203) 853-6880.
CIRCLE INQUIRY NO. 265

Word processing software, Electronic Typing, has been introduced on 8-in. diskettes. Running on the Z-89 microcomputer, the system includes a self-instruction diskette and manual written to be clear enough for first-time computer users. The diskettes expand the number of characters that can be stored almost 14 times to 936,000 characters from 68,000 with a 5¼-in. diskette. The capacity is expanded through the use of double-sided, double-density diskettes on the Z-47 or H-47 8-in. peripheral disk drives. Price: $395. Zenith Data Systems, 1000 Milwaukee Ave., Glenview, IL 60025, (312) 391-8181.
CIRCLE INQUIRY NO. 266

Disk doubling kit allows owners of 5-in. single-sided diskettes to safely convert those disks to double sided use. Disk Doubler takes advantage of the magnetic coating disk manufacturers place on both sides of their disks. Using the tools in the kit, the computer user can quickly measure, mark and punch new openings in the right places. A disk can be converted in 45 seconds or less. The kit contains everything needed to do this job except the disks themselves. A plexiglass template and pencil are used in marking the disks. A specially-configured steel hand-held punch is provided to cut the proper openings in the disks. The jaws of this tool have been covered with felt to prevent any chance of damage to disk media. The kit also includes a plastic storage pouch, assorted disk labels and stickers and detailed instructions. Price: $6.95. Beals Agency, 4141 Fairmount Ave., San Diego, CA 92105, (714) 284-1145.
CIRCLE INQUIRY NO. 267

Text processor for the Apple III computer, Docuwriter III, allows either 96K or 128K versions of the machine to create text file systems up to 126K. The system includes its own mailing list management system and custom form letter element. The advanced processor is designed with low overhead memory program overlays to increase system capacity and allow for linked files to create long report files. The entry system allows for centering, special form text creation, specific notation, footnoting, superscripting, subscripting, embedded custom strings, and underlining. Text entry can be line oriented or continuous. The edit features include block text movements, string replacement, insertion (single character, word, phrase or while line), deletion (character, word or line), global error detection, total text reformatting, and text merger. The system allows for on screen draft review or traditional draft report preparation. The system is designed to recognize special paragraph and chapter designations for economical preparation of large text assignments. The system requires

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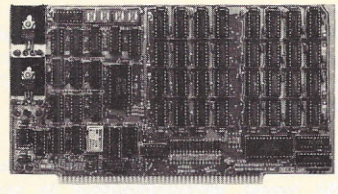
S-100 PRODUCTS



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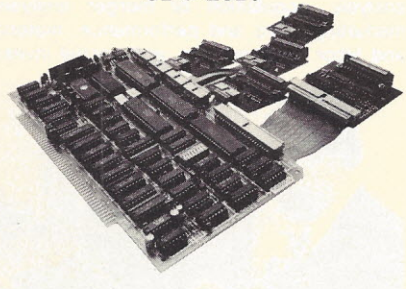

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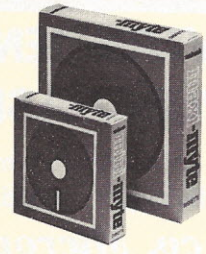

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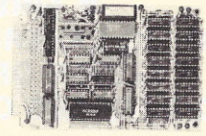

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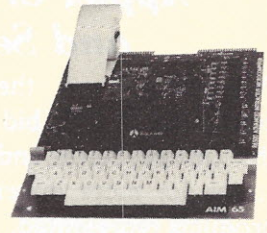

AIM 65 with 1K ram.....$425.00
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an Apple III with at least 96K of RAM, the SOS operating system package, an Apple modem eliminator, and a compatible serial letter quality printer. An optional second disk III drive is supported under user control. Price: $349.95. Charles Mann & Assoc., Micro Software Div., 7594 San Remo Trail, Yucca Valley, CA 92284, (714) 365-9718.
CIRCLE INQUIRY NO. 268

Software products for the Apple II include Datakeyper, an interactive data management system. Query capability is included that also allows some basic statistical reporting on the data. A flexible report generator feature allows the user to custom tailor reports. Other features are mailing list processing, sort, list, create, and edit. Bookkeyper, a basic business accounting system, is fully integrated with Datakeyper and provides for processing of accounts payable, receivables, and general ledger. Personal Budgetkeyper includes checkbook management and personal bills as well as expense statements and summary reporting. The products are available for 5¼-in. and 8-in. floppies and Corvus 10M-byte Winchester disks. Applesoft, DOS 3.3, or the language system are software prerequisites, on a minimum hardware of 48K-byte Apple II, CRT, and two 5¼-in. floppy disk drives. Prices: Datakeyper (diskette version)—$99; Corvus 10M-byte version—$449; Budgetkeyper—$195. ESP Computer Resources, 9 Ash St., Hollis, NH 03049, (603) 465-7264.
CIRCLE INQUIRY NO. 269

Financial planning software that enables CP/M based microcomputers to provide financial modeling and reporting capabilities is a highly expanded computerized columnar spread sheet, in concept. FPL (Financial Planning Language) can perform such tasks as profit and loss forecasts, commercial loan evaluations, pro forma statements, product line planning, budget planning and consolidation, product evaluation, cash flow management, real estate acquisition and development analysis, acquisition or merger analysis, marketing plans and performance, material and labor requirements, and captial invest-

ment analysis. Users can customize worksheets to needs by simply naming rows, columns, data relationships and report formats. Special report functions allow combination, extraction and comparison of separate sets of data. FPL operates on any 8080-Z80, Z80A type microcomputer with 60K memory and Microsoft Basic, version 5.X—making it applicable to most of the CP/M micro systems. The application program comes on an IBM format, single density diskette. Price: $695. Documentation alone: $30. Lifeboat Associates, 1651 Third Ave., New York, NY 10028, (212) 860-0300.
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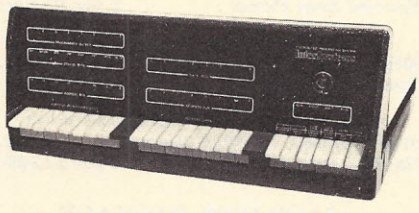

COMPLETE SYSTEM with InterSystem 64K RAM, I/O Board and double density disk controller board. Full 1-year warranty,
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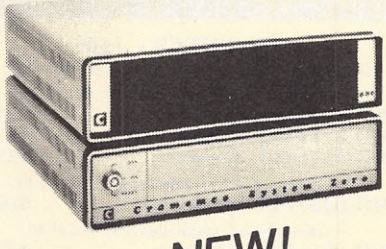

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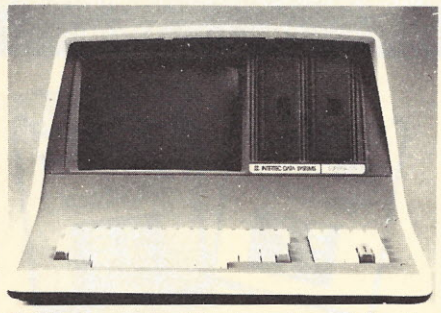

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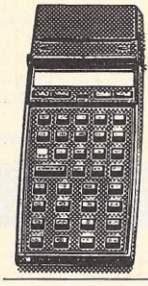

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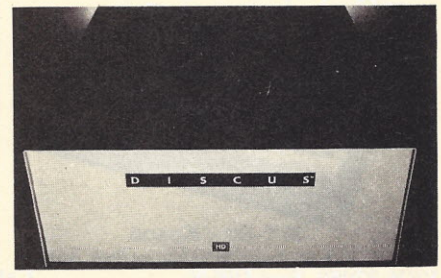

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All Morrow floppy disks include CP/M® 2.2 and Microsoft Basic 80

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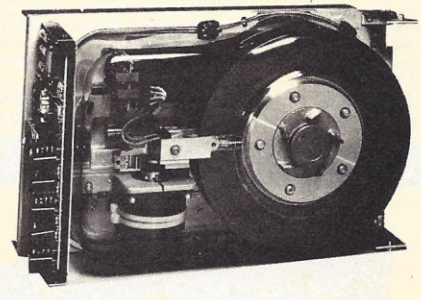

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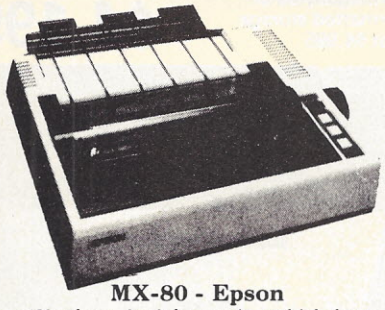

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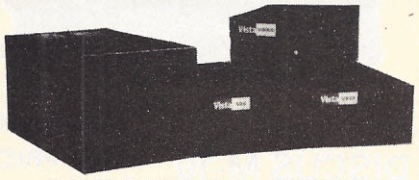

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IOM-5200A *List price $189.95* **$139.95**
D-CAT 300 baud, direct connect modem
IOM-5201A *Special sale price* **$189.00**
AUTO-CAT Auto answer/origiate, direct connect
IOM-5230A *Special sale price* **$239.95**

Accessories for Apple

16K MEMORY UPGRADE
Add 16K of RAM to your TRS-80, Apple, or Exidy in just minutes. We've sold thousands of these 16K RAM upgrades which include the appropriate memory chips (as specified by the manufacturer), all necessary jumper blocks, fool-proof instructions, and our 1 year guarantee.
MEX-16100K *TRS-80 kit* **$29.00**
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MEX-16102K *Exidy kit* **$29.00**

16K RAM Card - Microsoft
(There is life after 48K)
MEX-16300A *A & T* **$174.95**

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Two computers in one, Z-80 & 6502, more than doubles the power & potential of your Apple, includes Z-80 CPU card, CP/M 2.2, & BASIC-80*
CPX-30800A *A & T* **$279.95**

Atari 800 $799.95

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Real time clock w/battery back-up
IOK-2030A *A & T* **$109.95**

APPLE STICK - Micromate
Joy stick with pots for Apple II
SYA-1510A *A & T* **$49.95**

VISICALC - Personal Sftwr
The ultimate program for your Apple II
SFA-24101005M *Complete package* **$139.95**

DOS 3.3 UPGRADE - Apple
Upgrade your old DOS to the improved 3.3
IOD-2233A *Complete kit* **$64.95**

DISK DRIVE for APPLE
5¼" disk drive with controller for your Apple
MSM-12310C *with controller* **$475.00**
MSM-123101 *w/out controller* **$375.00**

8" DRIVES for APPLE
Controller, DOS, two 8" double densisty drives, cabinet, power supply, & cables
Special Package Price *Kit* **$1399.95**

PRINTER INTERFACE - C.C.S.
Centronics type I/O card w/ firmware
IOI-2041A *A & T* **$99.95**

AIO, ASIO, APIO - S.S.M.
Parallel & serial interface for your Apple (see Byte pg 11)
IOI-2050K *Par & Ser kit* **$129.95**
IOI-2050A *Par & Ser A & T* **$159.95**
IOI-2052K *Serial kit* **$89.95**
IOI-2052A *Serial A & T* **$99.95**
IOI-2054K *Parallel kit* **$69.95**
IOI-2054A *Parallel A & T* **$89.95**

A488 - S.S.M.
IEEE 488 controller, uses simple basic commands, includes firmware and cable, 1 year guarantee, (see April Byte pg 11)
IOX-7488A *A & T* **$399.95**

Disk Drives

*JADE's new dual disk sub-assemblies include: **Handsome** metal cabinet with **proportionally balanced** air flow system, **assembled & tested** dual drive power supply, **quiet whisper type** cooling fan, power-cable kit, lighted power switch, approved fuse assembly, line cord, **Never-Mar** rubber feet, and all necessary hardware to mount 2-8" disk drives - it's **all American made, guaranteed for six months**, and it's in stock!*

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END-000426 *kit w/2 8" drives* **$1495.00**
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8" DISK DRIVES
Highly reliable double density floppy disk drives
Shugart 801R single sided, double density
MSF-10801R *SA-801R* **$425.00**
Special Sale Price ..... ***2 for $790.00***

Shugart 851R double sided, double density
MSF-10851R *SA-851R* **$595.00**
Special Sale Price ..... ***2 for $1150.00***

Siemens FDD100-8D2 single sided, double density
MSF-201120 *6 mo warranty* **$385.00**
Special sale price ..... ***2 for $750.00***

Qume Datatrak 8 double sided, double density
MSF-750080 *SA-851R compatible* .. **$599.95**
Special sale price ..... ***2 for $1160.00***

JADE DISK PACKAGE
Double density controller, two 8" double density floppy disk drives, CP/M 2.2 (configured for controller), hardware and software manuals, boot PROM, cabinet, power supply, fan, & cables
Special Package Price *Kit* **$1395.00**

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DISKETTES - Jade
Bargain prices on magnificent magnetic media
5¼" single sided, single density, box of 10
MMD-5110103 *Soft sector* **$27.95**
MMD-5111003 *10 sector* **$27.95**
MMD-5111603 *16 sector* **$27.95**
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MMD-5220103 *Soft sector* **$39.95**
8" single sided, single density, box of 10
MMD-8110103 *Soft sector* **$33.95**
8" single sided, double density, box of 10
MMD-8120103 *Soft sector* **$39.95**
8" double sided, double density, box of 10
MMD-8220103 *Soft sector* **$49.95**

Video Monitors

13" COLOR MONITOR - Zenith
The hi res color you've been promising yourself
VDC-201301 ..... **$449.00**

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20 MHz, P31 phosphor video monitor with audio, exceptionally high resolution - A fantastic monitor at a very reasonable price
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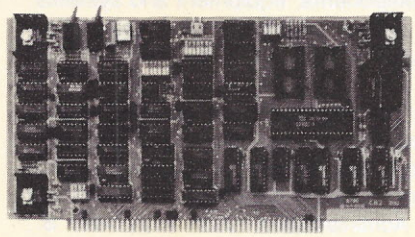
VDM-801230 *Video 100-80 12" B& W* **$189.9**
VDM-801250 *12" Green Phospor* **$189.9**
VDC-801310 *13" Color I* **$399.9**

Fast Service.

S-100 CPU



CB-2 Z-80 CPU - S.S.M.

2 or 4 MHz Z-80 CPU board with provision for up to 8K of ROM or 4K of RAM on board, extended addressing, IEEE S-100, front panel compatible.

CPU-30300K *Kit* **$239.95**
CPU-30300A *A & T* **$299.95**

THE BIG Z* - Jade

2 or 4 MHz switchable Z-80 CPU with serial I/O, accomodates 2708, 2716, or 2732 EPROM, baud rates from 75 to 9600*

CPU-30201K *Kit* **$145.00**
CPU-30201A *A & T* **$199.00**
CPU-30200B *Bare board* **$35.00**

2810 Z-80* CPU - Cal Comp Sys

2/4 MHz Z-80A CPU with RS-232C serial I/O port and on-board MOSS 2.2 monitor PROM, front panel compatible.*

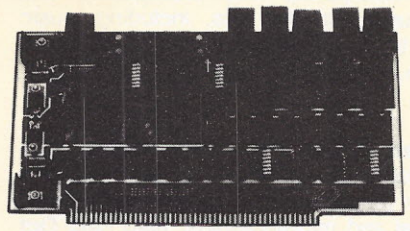
CPU-30400A *A & T* **$269.95**

SBC-200 - SD Systems

4 MHz Z-80 CPU with serial & parallel I/O ports, up to 8K of on-board PROM, software programmable baud rate generator, 1K of on-board RAM, Z-80 CTC.*

CPC-30200K *Kit* **$339.95**
CPC-30200A *Jade A & T* **$399.95**

S-100 I/O



I/O-4 - S.S.M.

2 serial I/O ports plus 2 parallel I/O ports

IOI-1010K *Kit* **$159.95**
IOI-1010A *A & T* **$219.95**
IOI-1010B *Bare board* **$35.00**

S.P.I.C. - Jade

Our new I/O card with 2 SIO's, 4 CTC's, and 1 PIO

IOI-1045K *2 CTC's, 1 SIO, 1 PIO* .. **$199.00**
IOI-1045A *A & T* **$259.00**
IOI-1046K *4 CTC's, 2 SIO's, 1 PIO* **$259.00**
IOI-1046A *A & T* **$319.00**
IOI-1045B *Bare board w/ manual* ... **$59.95**
IOI-1045D *Manual only* **$20.00**

Motherboards

ISO-BUS - Jade

Silent, simple, and on sale - a better motherboard

6 Slot (5¼" x 8⅝")

MBS-061B *Bare board* **$19.95**
MBS-061K *Kit* **$39.95**
MBS-061A *A & T* **$49.95**

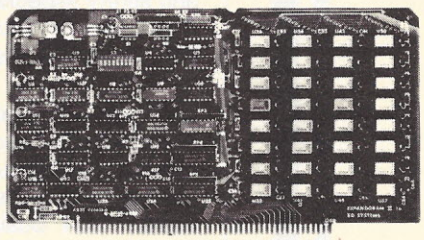
12 Slot (9¾" x 8⅝")

MBS-121B *Bare board* **$29.95**
MBS-121K *Kit* **$69.95**
MBS-121A *A & T* **$89.95**

18 Slot (14½" x 8⅝")

MBS-181B *Bare board* **$49.95**
MBS-181K *Kit* **$99.95**
MBS-181A *A & T* **$139.95**

S-100 Memory



EXPANDORAM II - S D Systems

4 MHz RAM board expandable from 16K to 64K

MEM-16630K *16K kit* **$275.95**
MEM-32631K *32K kit* **$295.95**
MEM-48632K *48K kit* **$315.95**
MEM-64633K *64K kit* **$335.95**
Assembled & tested ..... add **$50.00**

64K RAM - Calif Computer Sys

4 MHz bank port / bank byte selectable, extended addressing, 16K bank selectable, PHANTOM line allows memory overlay, 8080 / Z-80 / front panel compatible.

MEM-64565A *A & T* **$575.00**

MEMORY BANK - Jade

4 MHz, IEEE S-100, bank selectable, 8 or 16 bit, expandable from 16K to 256K

MEM-99730B *Bare board* **$55.00**
MEM-99730K *Kit, no RAM* **$219.95**
MEM-16730K *16K kit* **$249.95**
MEM-32731K *32K kit* **$289.95**
MEM-48732K *48K kit* **$324.95**
MEM-64733K *64K kit* **$359.95**
Assembled & tested ..... add **$50.00**

32K STATIC RAM - Jade

2 or 4 MHz expandable static RAM board uses 2114L's

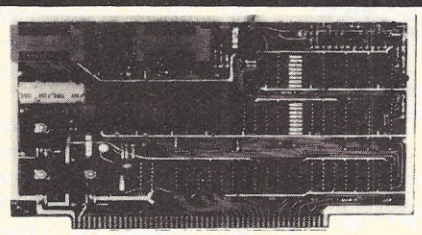
MEM-16151K *16K 4 MHz kit* **$169.95**
MEM-32151K *32K 4 MHz kit* **$299.95**
Assembled & tested ..... add **$50.00**

16K STATIC RAM - Cal Comp Sys

2 or 4 MHz 16K static RAM board, IEEE S-100, bank selectable, Phantom capability, addressable in 4K blocks

MEM-16160A *16K 2 MHz A & T* ... **$286.95**
MEM-16162A *16K 4 MHz A & T* ... **$289.95**
MEM-16160B *Bare board* **$50.00**

S-100 PROM Boards



PB-1 - S.S.M.

2708, 2716 EPROM board with built-in programmer

MEM-99510K *Kit* **$139.95**
MEM-99510A *A & T* **$199.95**

PROM-100 - SD Systems

2708, 2716, 2732, 2758, & 2516 EPROM programmer

MEM-99520K *Kit* **$219.95**
MEM-99520A *Jade A & T* **$269.95**

EPROM BOARD - Jade

16K or 32K uses 2708's or 2716's, 1K boundary

MEM-16230K *Kit* **$79.95**
MEM-16230A *A & T* **$119.95**

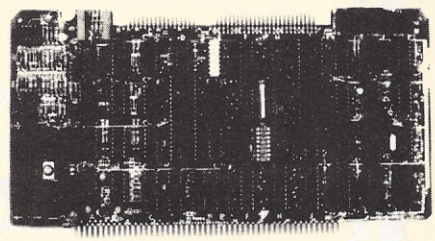
Mainframes

MAINFRAME - Cal Comp Sys

12 slot S-100 mainframe with 20 amp power supply

ENC-112106 A & T **$429.95**

S-100 Disk Controller



DOUBLE-D - Jade

Double density controller with the inside track, on-board Z-80A, printer port, IEEE S-100, can function on an interrupt driven buss*

IOD-1200K *Kit* **$299.95**
IOD-1200A *8" A & T* **$389.95**
IOD-1205A *5¼" A & T* **$389.95**
IOD-1200B *Bare board* **$65.00**

DOUBLE DENSITY - Cal Comp Sys

5¼" and 8" disk controller, single or double density, with on-board boot loader ROM, and free CP/M 2.2 and manual set.*

IOD-1300A *A & T* **$369.95**

VERSAFLOPPY II - SD Systems

New double density controller for both 8" & 5¼"

IOD-1160K *Kit* **$339.95**
IOD-1160A *A & T* **$379.95**

S-100 Video

VB-3 - S.S.M.

80 characters x 24 lines expandable to 80 x 48 for a full page of text, upper & lower case, 256 user defined symbols, 160 x 192 graphics matrix, memory mapped, has key board input.

IOV-1095K *4 MHz kit* **$345.00**
IOV-1095A *4 MHz A & T* **$395.95**
IOV-1096K *80 x 48 upgrade* **$39.95**

VDB-8024 - SD Systems

80 x 24 I/O mapped video board with keyboard I/O, and on-board Z-80A.*

IOV-1020K *Kit* **$399.95**
IOV-1020A *Jade A & T* **$459.95**

VIDEO BOARD - Jade

64 characters x 16 lines, 7 x 9 dot matrix, full upper/lower case ASCII character set, numbers, symbols, and greek letters, normal/reverse/blinking video, S-100.

IOV-1050K *Kit* **$99.95**
IOV-1050A *A & T* **$125.00**
IOV-1050B *Bare board* **$29.95**

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CALENDAR

Aug 10-14 Reliability and Life Testing, UCLA campus, Los Angeles, CA, short course for engineers and scientists involved with the reliability, design, product assurance, quality and safety aspects of components, equipment and systems. Short Course Program Office, 6266 Boelter Hall, UCLA Extension, Los Angeles, CA 90024, (213) 825-1047.

Aug 10-14 Seminars for the Systems Analyst, Grand Portage Lodge and Convention Center, Grand Portage, MN, comprehensive courses covering technology and interpersonal management skills. Pam Jensen, Executive Development Center, 324 Business Administration, 271 19th Ave. S., University of Minnesota, Minneapolis, MN 55455.

Aug 12-15 New York Computer Expo, Sheraton Centre, New York, NY, demonstrations of computer equipment aimed towards a mixed audience of business, professional and personal end users. Five-hour tutorial on business computing will be conducted daily. NYCE, 110 Charlotte Pl., Englewood Cliffs, NJ 07632, (201) 569-8542.

Aug 18-20 International Symposium on Electromagnetic Compatibility, U. of Colorado, Boulder, CO, providing information on how to measure and ameliorate problems of unwanted electromagnetic radiation in manufacturing electronic products. Charlotte Tyson, EMC '81, IBM, P.O. Box 1900, Boulder, CO 80302, (303) 447-5072.

Aug 26-29 National Small Computer Show, New York Coliseum, New York, NY, lectures, seminars, and exhibitions of microcomputer equipment. NSCS, 110 Charlotte Pl., Englewood Cliffs, NJ 07632, (201) 569-8542.

Aug 28-30 Personal Computer Arts Festival, Philadelphia Convention Center, Philadelphia, PA, discussions and displays of computer usage in the arts, including music synthesis, composition tools, digital sound synthesis, signal processing, video, film, sculpture. PCAF-81, Box 1954, Philadelphia, PA 19105.

Sep 1-3 Computerized Office Equipment Expo, Civic Center, Atlanta, GA, displaying new equipment for data and word processing, information management, telecommunications, records storage/retrieval and micrographics. Also held Oct 20-22 at Astrohall in Houston, TX and Apr 6-8 '82 at O'Hare Exposition Center, Rosemont, IL. Cahners Exposition Group, 222 W. Adams St., Chicago, IL 60606, (312) 263-4866.

Sep 10-12 Personal Computer World Show, Cunard Hotel, Hammersmith, London, England, demonstrations and discussions on wide variety of small computer systems. Timothy Collins, Personal Computer World Show, 11 Manchester Sq., London WIE 2QZ, England.

Sep 14 Invitational Computer Conference, Boston Marriott, Newton, MA, seminar/display directed towards the needs of quantity buyers of computer and peripheral equipment. Also held: Oct 1, Radisson South, Minneapolis, MN; Oct 27, Sheraton Hotel, Valley Forge, PA; Oct 29, Tyson's Marriott, Washington, DC. B.J. Johnson & Assoc., 2503 Eastbluff Dr., Suite 203, Newport Beach, CA 92660, (714) 644-6037.

Sep 14-17 Software Info '81, Merchandise Mart Expocenter, Chicago, IL, talks and demonstrations on increasing productivity through packaged software. Software Info, 1730 N. Lynn St., Suite 400, Arlington, VA 22209, (703) 521-6209.

Sep 15-17 Wescon '81, Brooks Hall and Municipal Auditorium and Hilton Hotel, San Francisco, CA, conferences and demonstrations on aerospace avionics, data communications, components and devices, consumer electronics, energy, medical electronics, and office automation. Electronic Conventions, Inc., Suite 410, 999 N. Sepulveda Blvd., El Segundo, CA 90245, (213) 772-2965.

Sep 15-24 Machine Tool Fair, Hanover Fairgrounds, Hanover, Germany, more than 1,700 exhibitors from 80 different countries presenting new developments in machine tools and general metalworking technologies. Hanover Fair Informations Center, Box 338, Whitehouse, NJ 08888, (800) 526-5978.

Sep 16-18 Integrated Management Systems Seminar, Holiday Inn at O'Hare Airport, Schiller Park, IL, course on improving management skills, tailored to the needs of the electronics industry. EIA Education, Suite 405, 2001 Eye St. N.W., Washington, D.C. 20006.

Sep 21 Robotics course, Centennial College, Ontario, Canada, first in a series of ten-week courses running through November. This course covers the usage of robots in industry. Other courses and beginning dates: digital logic and microprocessors, Sep 22; history of programmable controllers, Sep 23; Intel 8080 and 8085 microprocessors, Sep 24. Coordinator of Technical Programs, Centennial College of Applied Arts and Technology, Box 631, Station A, Scarborough, Ontario, Canada, M1K 5E9.

Sep 21-23 Structured Information Systems Seminar, series of two-and-a-half day seminars designed for DP/MIS management; focusing on a structured approach to information systems planning. Susan Shaw, InfoCom, MRB Box 125-17, Bangor, ME 04401, (207) 947-6886.

Sep 21-25 Convention Informatique 1981, Palais des Congres, Paris, France, discussions on office automation and telematics, legal, economic and social aspects of computerization. Secretariat de la Convention Informatique 4, Place de Valios, 75001 Paris, France, telephone (01) 261.52.42.

Sep 21-25 International Switching Symposium, Hotel Bonaventure, Montreal, Canada, discussions on telecommunications switching, including representatives from around the world. International Switching Symposium, P.O. Box 56, Station "Ile des Soeurs", Verdun, Quebec, Canada H3E 1J8, (514) 761-5831.

Sep 22-24 National Electronics Packaging and Production Conference, O'Hare Exposition Center, Rosemont, IL, more than 275 displays relating to the design processing and manufacture of printed circuit boards and microelectronic devices. Cahners Exposition Group, 222 W. Adams St., Chicago, Il 60606, (312) 263-4866.

BOOK REVIEWS

Fortran 77—Language and Style
by Michael J. Merchant
Wadsworth Publishing Co., Belmont, CA

Reviewed by David D. Busch

This book is more than an easy-to-understand introduction to Fortran. It is a concise guide to the basics of structured programming and style. Computer neophytes who are learning Fortran 77 as a first language can start their involvement in the field well-grounded in good programming habits. Those already proficient in Basic or some other high-level language will find a wealth of valuable tips that will help them, even if they never write a line of Fortran.

Merchant is an excellent teacher as well as computer scientist. This is both text and reference manual, workbook and guidebook. Despite Fortran's utility as a mathematical tool, a heavy math background is not needed to absorb the language.

Individual chapters are designed for structured learning. Concepts are introduced one at a time, and summarized throughout the chapter. After a given page has been looked over, the student can examine the boxed recap and, if it makes sense, move on to the next topic.

A general summary at the end of the chapter, a vocabulary list, and a series of exercises provide the reader with a simple self-testing method of double-checking to see if everything is understood.

Those who have confined their efforts to Basic in the past will find that discovering Fortran through this study guide is a little like learning Latin. The perspective gained from learning another high-level language deepens one's appreciation of Basic's strengths and limitations. Merchant provides this insight in neat, easy-to-absorb Fortran packages.

447 pages $15.95

The Micro Millennium
by Christopher Evans
Washington Square Press, New York, NY

Sages of the previous century predicted the coming of the automobile—but traffic jams and smog caught everyone by surprise. Foretelling upcoming technological advances, whether they are television or teletext, is easy. Arriving at sound conclusions as to how they will affect us is something else again.

In this book, Christopher Evans attempts to show how the proliferation of microprocessors in the 1980s will revolutionize politics, education, economics, and change the very quality of our lives. Though elements of the cashless society, robot assembly-line workers, and computer-aided instruction are already upon us, Evans seems to be one of the few who have thought these concepts through to some logical conclusions.

For example, he feels that when electronic funds transfer supplants paper money entirely, one result will be a sharp reduction in the crime rate. Most large-scale illegal businesses rely on tax evasion and the unrecorded transfer of paper money to keep their operations under cover. Casual criminals will be hit just as hard, as home security systems become commonplace and sophisticated, and even our credit cards take on a low order of intelligence.

The book is divided into sections, dealing with the growth of computers in the past, present, and short-, medium-, and long-term futures. Though written for the layperson, even well-read computer hobbyists will find the discussions informative, for Evans tackles some complex topics. He builds a background for the development of the microprocessor by explaining how the first computing machines were built by Pascal, Babbage, and Hollerith. A whirlwind tour through the 30s, 40s, and 50s brings the reader to the modern age of computers.

There Evans delves into the technological advances we can expect in the future. Anecdotes and analogies bring many of his points into sharp focus. To illustrate just how compact computers of the future can become, the author recounts how he was proudly displaying a microprocessor chip to some friends when it slipped from a pair of tweezers to fall to the top of his dishelved desk—never to be found again. Also explored are robots, artificial intelligence, and a host of political and social issues.

Evans, a well-known computer scientist and experimental psychologist, has produced a fascinating look at the future of microprocessors. Though he died in 1979, shortly after this book was written, his vision rings true in 1981. ***—DDB***

308 pages $3.50

6809 Microcomputer Programming & Interfacing with Experiments
by Andre C. Staugaard, Jr.
Howard W. Sams, Indianapolis, IN

Reviewed by Dennis Doonan

This is an instructional text and application handbook for the advanced 6809 microprocessor. Its clear discussions include examples, illustrations and numerous review questions. While it assumes a basic knowledge of the 6800, its readable style presents little difficulty for anyone with some microcomputer background. It provides a sound understanding of the 6809.

The first half of the book discusses software and architecture. It begins with a discussion of the evolution of the 6800 into the next generation 6809. An overview of 6809 hardware, architecture and software is developed and expanded. The 6809 is compared to the 6800 and its improvements are described in detail.

Much of the 6809's power comes from its additional addressing modes. This book provides an understanding of these modes so the reader can fully utilize its power. The additional addressing modes for each instruction add power and versatility not found on the 6800. Tables summarize the instructions and addressing modes.

The second half deals with hardware and interfacing. A functional description of each pin leads the discussion. Input/output concepts and interrupts are presented with timing diagrams and flowcharts. Since the 6809 is a systems device, the discussions concentrate on system applications.

A minimum system is developed, then expansion is described. Hardware and software for a simple data acquisition system is designed around the 6809. The interfacing discussions include both the new and the existing 6809 family support devices.

270 pages $13.95

Basic Business Software
by E. G. Brooner
Howard W. Sams, Indianapolis, IN

Reviewed by Rocky Smolin

This book is a very successful attempt to demystify the small computer system. It provides insight into how good business software is designed, so small business operators can effectively evaluate the wide variety of available software.

Assuming little knowledge on the part of the reader, Brooner begins with fundamental information—what exactly constitutes a small business system, how businesses benefit from

computerization, the fundamentals of software (languages, operating systems, etc), a little information on how to choose appropriate business software, and a description of how programs are put together.

Next he discusses the information storage and retrieval topics common to all software—how data is stored, how disks work, file structures, and the like. Details of specific business applications—inventory control, payroll, general ledger, and word processing are included. The final chapter introduces the ideas of business modeling and simulation.

The book is written in a simple, comprehensible fashion. Included are several complete business programs, along with flowcharts and documentation. It provides an excellent, if somewhat simplistic, introduction to the world of small business computing. This reviewer would have liked to see a more indepth discussion of each application, additional chapters on accounts receivable, accounts payable, order entry, and purchasing systems, as well as leads on where and how to shop for business software.

140 pages $9.95

RECENT BOOKSHELF ADDITIONS

Why Do You Need a Personal Computer?
by Lance A. Leventhal
John Wiley & Sons, Somerset, NJ $8.95

Using Microcomputers in Business: A Guide for the Perplexed
by Stanley S. Veit
Hayden Book Co., Rochelle Park, NJ $9.95

Pet Interfacing
by James M. Downey and Steven M. Rogers
Howard Sams, Indianapolis, IN $16.95

Man-Machine Systems
by Thomas B. Sheridan and William R. Ferrell
MIT Press, Cambridge, MA $12.50

Data Communications: A User's Guide
by Kenneth Sherman
Prentice-Hall, Englewood Cliffs, NJ $21.95

The Apple II User's Guide
by Lon Poole, Martin McNiff and Steven Cook
Osborne/McGraw Hill, Berkeley, CA $15

Business System Buyer's Guide
by Adam Osborne and Steven Cook
Osborne/McGraw Hill, Berkeley, CA $7.95

CBasic Software Directory
Compiler Systems, Sierra Madre, CA $14.95

Guide to Systems Applications
by John P. Grillo and J.D. Robertson
Wm. C. Brown Co., Dubuque, IA $17.95

Free Literature

Audio and general purpose connectors and AC receptacles are detailed in 36-page catalog. Catalog no. C502f includes product descriptions, full engineering specifications, detailed drawings, and mating charts showing connecting compatibility with similar products. Included are such products as Tini Q-G miniature connectors and accessories; Q-G audio connectors including a variety of panel and wall plate receptacles, adapters, inserts and accessories; Slim-Line audio connectors and accessories; various other microphone connectors, CB connectors, and phono plugs and jacks; as well as AC receptacles for electrical/electronic applications. Switchcraft, Inc., 5555 N. Elston Ave., Chicago, IL 60630.

CIRCLE INQUIRY NO. 201

HDC interface, a standardized fiber optic system developed by ITT Cannon Electric, Honeywell and DuPont, is detailed in a 4-page publication. Brochure HDC-1 includes 10 color photographs of the compatible cable/connector/diode hardware used in high density, single or multichannel applications. Also included is information on materials, performance data, outline dimensions, termination tooling, and instruction on how to order either the complete link or separate components. ITT Cannon Electric, 666 E. Dyer Rd., Santa Ana, CA 92702.

CIRCLE INQUIRY NO. 202

Distributed processing is discussed in 32-page booklet. The publication presents history of Digital Equipment Corp's experience in interactive computing, its long-standing involvement with education, and summaries of the company's computer hardware, software, communications, service and support for academic and administrative environments. Brochure EA 19160-87, Printing and Circulation Services, Digital Equipment Corp., 444 Whitney St., Northboro, MA 01532.

CIRCLE INQUIRY NO. 203

Digital storage oscilloscope is described in 4-page bulletin. The device is for capturing transient, recurrent and long-term events in electrical, electromechanical, medical and physical testing applications. Complete specifications, operational details, illustrations and optional accessories are given in Bulletin 449-17. Gould Inc., Instruments Div., 3631 Perkins Ave., Cleveland, OH 44114, (216) 361-3315.

CIRCLE INQUIRY NO. 204

Guide to software, systems and information sources in CAD/CAM (computer-aided-design/computer-aided-manufacturing) is presented in the Harvard Newsletter on Computer Graphics. The guide contains descriptions of source materials providing the name of each supplier, including a complete mail address, person to contact and telephone number. The intent is to help CAD/CAM suppliers and users to track recent offerings in the field. Write on letterhead, enclosing a self-addressed envelope, pre-stamped ($.36). CAD/CAM Guide, c/o The Harvard Newsletter on Computer Graphics, Service Dept., P.O. Box 89, Sudbury, MA 01776.

CIRCLE INQUIRY NO. 205

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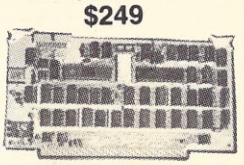

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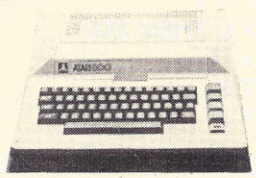

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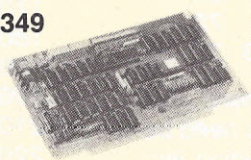

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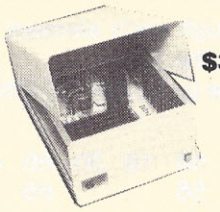

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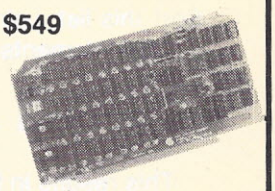

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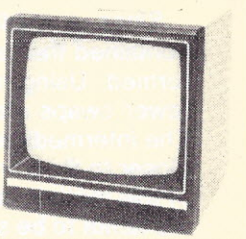

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About Sorts
continued from page 69

The 10 must travel through each element position to reach its proper place in the list.

Consider a sublist made up of the 1st, 4th, 7th, 10th, and 13th elements.

```
34  53  73  33  31  11  56  16  30  86  45  64  10
34          33          56          86          10
```

Sort this list, using the Insert sort of method four and put the elements back.

```
10          33          34          56          86
10  53  73  33  31  11  34  16  30  56  45  64  86
```

This results in four exchanges instead of the original 12, to move the 10 to its proper position in the list. This method permits an element in the list to make jumps across many element positions.

Form a sublist of the 2nd, 5th, 8th, and 11th elements, sort the following sublist using method four and replace into the full list.

```
10  53  73  33  31  11  34  16  30  56  45  64  86
    53          31          16          45
    16          31          45          53
10  16  73  33  31  11  34  45  30  56  53  64  86
```

Another sublist of the 3rd, 6th, 9th, and 12th elements follows.

```
10  16  73  33  31  11  34  45  30  56  53  64  86
        73          11          30          64
        11          30          64          73
10  16  11  33  31  30  34  45  64  56  53  73  86
```

Since a sublist containing the 4th element also contained the 1st element, no further sublists need be formed. Using method four to sort this resulting list, fewer swaps are necessary than with the original list. The intermediate process moved most elements much closer to their final position in the list. The general form of this method is to find a convenient increment for the elements to be sorted over, then reduce the increment and sort again. The process is repeated until the increment is one, at which time the process is the Straight Insert Sort of method four. This method was called a Diminishing Increment Sort by its author, Donald Shell. It is more popularly called Shell Sort.

The choice of the increments (3 and 1 in this example) is not arbitrary. Excellent results occur if the following choices are made. The first increment is chosen to be half of one less than a power of 2, just less than the number of elements in the list. That is, if N is the number of elements in the list, find K such that: $2^K<N<2^{K+1}$. Then, choose the beginning increment $L = ((2^K) - 1)/2$. This number can be calculated directly by using this formula:

```
L = (2^INT(LOG(N)/LOG(2))) - 1
```

LOG(N)/LOG(2) is necessary when Basic doesn't provide a log base 2 function.

Each successive increment is half the previous increment with fractions discarded. This will always result in choices from the list:

1, 3, 7, 15, 31, 63, 127, 255, 511, 1023, etc.

The outer loop of method five is concerned with the diminishing increment:

```
130 L = (2^INT(LOG(N)/LOG(2))) - 1
140 L = INT(L/2)
150 IF L < 1 THEN 300
160 REM INSERT SORT WITH INCREMENT L
290 GOTO 140
300 REM SORT DONE
```

After the pass with increment set to 1 is complete, the sort is complete. Within this outer loop, an Insert Sort similar to method four is used to sort the sublist:

```
160 FOR J = 1 TO L
170 FOR K = J+L TO N STEP L
180 I = K
190 T = A(I)
200 C = C + 1
210 IF A(I-L) ⩽ T THEN 260
220 A(I) = A(I-L)
230 S = S + 1
240 I = I - L
250 IF I > L THEN 200
260 A(I) = T
270 NEXT K
280 NEXT J
```

Combining the two phases produces the final product:

```
100 REM METHOD FIVE - SHELL SORT
130 L = (2^INT(LOG(N)/LOG(2))) - 1
140 L = INT(L/2)
150 IF L < 1 THEN 300
160 FOR J = 1 TO L
170 FOR K = J+L TO N STEP L
180 I = K
190 T = A(I)
200 C = C + 1
210 IF A(I-L) ⩽ T THEN 260
220 A(I) = A(I-L)
230 S = S + 1
240 I = I - L
250 IF I > L THEN 200
260 A(I) = T
270 NEXT K
280 NEXT J
290 GOTO
300 REM SORT DONE
```

The performance of this sort is based on the worst case. It cannot perform any worse than method four (Insert Sort). It should show the best improvement over method four when the elements are badly out of place. Most performance claims are based on using this method to sort actual random sets of elements. As will be seen in the comparisons section of the next installment, improvement is dramatic.

The timing comparisons will demonstrate that the first four methods presented here are not considered useful for randomly ordered lists. The Shell Sort performs about ten times faster than the Insert Sort. If the list is originally ordered, it is still approximately as fast as the Insert Sort. The Insert Sort is still one of the fastest methods when the original list is already in order or when a new element is added to an ordered list.

The concluding installment next month will be aimed at two other faster algorithms, Heap Sort and Quicksort. □

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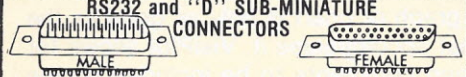

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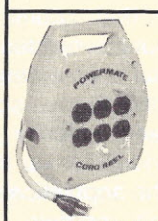

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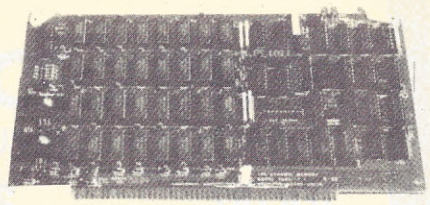

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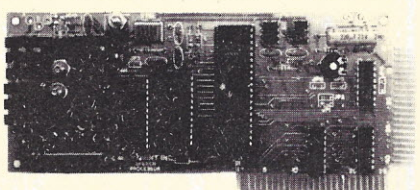

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Exclusive Product Review

continued from page 72

VisiPlot

Graphic presentations provide one of the best ways to convey complex information in a format that can be grasped at a glance. Most microcomputer software has been woefully lacking in any implementation of graphics. VisiPlot changes all that by introducing a package intended to provide the user with access to the powerful graphics capabilities of the Apple's 6502 processor.

It is a set of programs designed to enable a user to generate many different kinds of charts and graphs from business information. The user can choose from line, bar, area, pie, high-low and scatter graphs, or combinations of these. Each chart can have up to 150 points, and can use multiple colors or symbols. Charts can use points, lines between points and solid, outlined or shaded bars. The plotting of a graph can be done with points or symbols.

Once a graph is prepared, it may be saved to disk for display later, or printed out, pixel by pixel, on the system printer. This feature, which is critical for implementation in a business environment, has been well thought out. The programmers included drivers to allow a number of the printers to be used, including the Apple Silentype, Integral Data 440 and 445 Paper Tigers, the Trendcom 200 and the NEC spinwriters. In fact, most of the printers that can be plugged into the Apple can be used to dump out graphs and charts created by VisiPlot. Of course, the printed graph will be in black and white instead of the color presentation available on the monitor.

The value of a graph or chart is only as good as the documentation that accompanies it. VisiPlot allows for extensive titling and comments to be included on the face of the graph. Titles can be in normal or boldface type, and to get fancy, the user can even specify reverse video. Comments can be made right on the face of the graph to explain an unusual variation or significant change.

Anyone who has ever had to wrestle with preparing a graph or chart has faced the problem of setting scales on the vertical and horizontal axis. The VisiPlot software does that automatically for the user, although there are manual overrides which can be invoked. The manual contains an extensive discussion of the ramifications of setting various scales and guides the user in preparing an aesthetically pleasing presentation. The program provides for up to 12 divisions of scale.

The sophisticated user can prepare graphs and charts which contain comparative information. Different symbols or thicknesses of line can be used to differentiate the information. Combined with the feature which allows several different graphs to be presented on the screen at the same time, the software allows the user to construct extremely sophisticated presentations of data.

One question always present when evaluating such a powerful program is whether the effort made by the user to learn the program and master its use will be time-effective over just getting a pencil out and preparing the graph the time-honored manual way. In this case, the sophistication of the program, combined with the ability to access numerous data bases through the DIF file structure more than outweigh the start-up time

involved in learning the program. The manual is tutorial in nature, anyway, so a first-time user is led carefully through the program.

VisiTerm

This is an easy-to-use software package that lets the user employ his Apple to communicate with other Apples, remote timesharing computers or inhouse mainframe computers. The user can transfer text files, graphics files, programs and data files between the Apple and an outside computer. The manual describes in a step-by-step fashion that even an inexperienced beginner can understand how to set up the hardware and the software required. Sample sessions show how to communicate between two Apples, and an Apple to an outside mainframe computer.

The Apple owner can reap substantial benefits from the VisiTerm program. It opens up a whole new ability to access data bases with current news, sports information, legal information, library catalogs, etc. Some of the other things a user can do with the program include:

- provide input and receive output from a host mainframe computer, so that the Apple becomes a remote terminal
- send and receive electronic mail (through a timesharing service, or direct Apple to Apple)
- program in languages not available on the Apple (i.e. program on mainframe computers) and run large and unusual programs not available on the Apple (i.e. through the mainframe)
- send and receive databases, and store the results on the Apple

The program uses a 60 to 80 character high resolution display on the screen, and permits variable-sized letters. Several character sets are provided, or the user can design his own. The user can also modify the screen display to increase or narrow the space between lines of text.

VisiTerm allows the user to meet the terminal requirements of almost any timesharing or mainframe computer by reconfiguring the options on-line. Speeds of from 10 to 120 characters per second are supported, and stop bits or other communications protocols can be added. To make the implementation easier, frequently used keystroke sequences, such as log-on lines (account number and password) can be predefined. All the user has to do to invoke them is press a single character name, which causes VisiTerm to cause the entire sequence to be sent as if the user had typed it at the keyboard.

When receiving lengthy reports or files, it's important to be able to store the received materials on disk. VisiTerm allows the user to immediately store on disk what is being received. Further, the software includes utilities that allow the user to print any text file, and convert program files into text files. Files in binary, integer Basic or floating point Basic can be converted into text files.

VisiDex

Businessmen discovered long ago that one of the best ways to store information is to put it on index cards and file them. Sales lists, calendar ticker files, property records, payroll files and a host of other business information has traditionally been stored on index cards. For the past several years, company after company has attempted to offer programs that would allow a businessman to replace his cards with a computer.

Most of the data base programs available are just too complex for the kind of information which is typically stored on index cards. The data base programs are complex to set up and bulky to operate. An unsophisticated user is more than likely to be lost before he inputs the first data. The company has introduced a program that may be the solution to the dilemma.

VisiDex is a program that can store and retrieve information entered on the screen in a free-form, unstructured way. Up to twenty lines of text may be entered on each card or screen. The information is then stored on disk, and can be called back by keyword or date. Up to 36 different keywords can be specified in a single screen. Thus, information can be cross referenced by many criteria. The computer's screen truly becomes an electronic index card.

VisiDex does not require that the user define fields or data element types. About the hardest decision is whether to use reverse video or flashing characters. The information can be typed in completely unstructured, as it is thought of by the user, just as it would be typed onto an index card.

On the other hand, if the user desires to set up some structure, the program can be used to set up a data template, which has fields just like those seen on most data base manager programs. The files can be sorted or searched on any of the field contents. The system can easily be used as a tickler file or calendar reminder, since features are integrated into the package that allow one to call information by date. There's even a PRINT CALENDAR command. If the user has a clock card in his Apple, the system can be used as a sophisticated alarm clock—beeping the user at the appropriate time to remind him of an important appointment.

What kinds of things would be appropriate for VisiDex? The manual includes a list of 101 things. Some of the best applications include appointment calendar, name and address list, phone directory and index of important magazine articles.

To be sure, VisiDex was never intended to replace data base managers, such as the CCA. Sophisticated data base management systems are designed primarily for numerical and statistical information. VisiDex on the other hand, is designed primarily to store text information. The system is easy to use, and is designed for the businessman who has neither the time nor the inclination to learn to use complex data base systems. There's really no need to go to all that trouble—VisiDex will handle most of the common needs.

There are a lot of businessmen who will be able to justify buying an Apple computer based on these new software packages. The power they can unleash in even the smallest business can be a significant factor in achieving greater productivity and efficiency. The software is attractively and professionally packaged, with well-written and carefully indexed manuals that are refeshingly simple and step-by-step in their tutorials. A businessman could easily choose any of these programs as his first Apple program and expect a successful implementation.

Personal Software has taken a giant step forward in making the Apple a serious business computer. □

Let your Computer Write its own Programs

continued from page 104

Program listing

```
10 CLEAR 5000
20 DIM LN$(100)
30 P$="  PRINT "+CHR$(34)+"      "
40 P1$=CHR$(34)
50 GOTO 90

60 ' ****** INCREMENT LINE NUMBER COUNTERS ******

70 LN=LN+IC:CU=CU+1:LN$(CU)=STR$(LN)+"  ":RETURN

80 ' ****** ENTER LINE NUMBER PARAMETERS ******

90 CLS:PRINT:PRINT
100 INPUT "ENTER BEGINNING LINENUMBER";BLN$
110 INPUT "ENTER LINE NUMBER INCREMENT";IC$
120 IC=VAL(IC$)
130 LN=VAL(BLN$)-IC

140 ' ****** CREATE 'CLEAR' AND 'DIM' STATEMENTS ******

150 GOSUB 70
160 LN$(CU)=LN$(CU)+"CLEAR MEM/3*2"
170 INPUT "WILL THIS PROGRAM STORE DATA IN A STRING ARRAY";AN$
180 IF LEFT$(AN$,1)="N" GOTO 310
190 GOSUB 70
200 INPUT "WILL THE ARRAY HAVE ONE OR TWO DIMENSIONS";AN$
210 DI=VAL(AN$)
220 IF DI<1 OR DI>2 GOTO 200
230 IF DI=2 INPUT "HOW MANY ELEMENTS BY HOW MANY ELEMENTS ";ROW,COL
    :GOTO 250
240 INPUT "HOW LARGE SHOULB THE ARRAY BE";ROW
250 LN$(CU)=LN$(CU)+"DIM DA$("+STR$(ROW)
260 IF DI=1 THEN LN$(CU)=LN$(CU)+")":GOTO 310
270 LN$(CU)=LN$(CU)+","+STR$(COL)+")"
280 GOSUB 70
290 LN$(CU)=LN$(CU)+"NC="+STR$(COL)

300 ' ****** CREATE A MENU ******

310 INPUT "WILL THIS PROGRAM NEED A MENU";AN$
320 IF LEFT$(AN$,1)="N" GOTO 740
330 GOSUB 70
340 LN$(CU)=LN$(CU)+"CLS:PRINT:"+P$+"   **********  MENU **********"
    +P1$+":PRINT"
350 IM(1)=LN
360 INPUT "HOW MANY CHOICES ON THE MENU";CH$
370 MI=VAL(CH$)
380 IF DI=0 GOTO 410
390 INPUT "WILL THE CHOICES INCLUDE 'SAVE FILE TO DISK' AND 'LOAD FILE FROM DISK '";AN$
400 IF LEFT$(AN$,1)="Y" THEN IOFLAG=2
410 CH=VAL(CH$)
420 CH=CH-IOFLAG
430 FOR N=1 TO CH
440 PRINT "ENTER MENU CHOICE # ";N
1040 GOSUB 70
1050 LN$(CU)=LN$(CU)+" OPEN "+P1$+"O"+P1$+",1,F$"
1060 GOSUB 70
1070 LN$(CU)=LN$(CU)+" PRINT #1,NF"
1080 GOSUB 70
1090 LN$(CU)=LN$(CU)+"FOR N=1 TO NF"
1100 GOSUB 70
1110 IF DI=2 THEN LN$(CU)=LN$(CU)+"FOR COL=1 TO NC":GOSUB 70
1120 LN$(CU)=LN$(CU)+"PRINT #1,DA$(N"
1130 IF DI=2 THEN LN$(CU)=LN$(CU)+",COL)" ELSE LN$(CU)=LN$(CU)+")"
1140 LN$(CU)=LN$(CU)+";"+P1$+","+P1$
1150 GOSUB 70
1160 LN$(CU)=LN$(CU)+"NEXT"
1170 IF DI=2 THEN LN$(CU)=LN$(CU)+" COL,N"
1180 GOSUB 70
1190 LN$(CU)=LN$(CU)+"CLOSE"
1200 GOSUB 70
1210 LN$(CU)=LN$(CU)+"RETURN"

1220 ' ****** ADD MISC. MODULES ******

1230 INPUT "DO YOU WANT A 'CLEAR SCREEN' SUBROUTINE";AN$
1240 IF LEFT$(AN$,1)="N" GOTO 1290
1250 GOSUB 70
1260 LN$(CU)=LN$(CU)+"   REM ****** CLEAR SCREEN SUBROUTINE ******"
1270 GOSUB 70
1280 LN$(CU)=LN$(CU)+"CLS:PRINT:PRINT:RETURN"
1290 INPUT "DO YOU WANT AN 'INKEY$-INPUT' SUBROUTINE";AN$
1300 IF LEFT$(AN$,1)="N" GOTO 1400
1310 GOSUB 70
1320 LN$(CU)=LN$(CU)+"  REM ****** INKEY$ INPUT SUBROUTINE *****"
1330 GOSUB 70
1340 LN$(CU)=LN$(CU)+"A$=INKEY$:IF A$="+P1$+P1$+" GOTO "+STR$(LN)
1350 GOSUB 70
1360 LN$(CU)=LN$(CU)+"A=VAL(A$)"
1370 GOSUB 70
1380 LN$(CU)=LN$(CU)+"RETURN"

1390 ' ****** SAVE FINISHED MODULES TO DISK ******

1400 CLS:PRINT
1410 INPUT "ENTER THE NAME OF THIS PROGRAM";F$
1420 OPEN "O",1,F$
1430 FOR N1=1 TO CU
1440 PRINT #1,LN$(N1)
1450 NEXT N1
1460 CLOSE
```

Sample run

```
ENTER BEGINNING LINENUMBER? 100
ENTER LINE NUMBER INCREMENT? 10
WILL THIS PROGRAM STORE DATA IN A STRING ARRAY? YES
WILL THE ARRAY HAVE ONE OR TWO DIMENSIONS? 2
HOW MANY ELEMENTS BY HOW MANY ELEMENTS ? 40,5
WILL THIS PROGRAM NEED A MENU? YES
HOW MANY CHOICES ON THE MENU? 5
WILL THE CHOICES INCLUDE 'SAVE FILE TO DISK' AND 'LOAD FILE FROM
 DISK '? YES
ENTER MENU CHOICE #  1
? ENTER NEW MAGAZINES
ENTER MENU CHOICE #  2
? UPDATE EXISTING MAGAZINES
```

```
450 INPUT MENU$(N)
460 NEXT N
470 FOR N=1 TO CH
480 GOSUB 70
490 LN$(CU)=LN$(CU)+P$+STR$(N)+".)   "+MENU$(N)+P1$
500 NEXT N

510 ' ****** IF DISK I/O DESIRED, CREATE THESE MENU CHOICES ******

520 IF IOFLAG=2 THEN GOSUB 70:LN$(CU)=LN$(CU)+P$+STR$(N)+".)  "+"LOAD FILE FROM DISK"+P1$:GOSUB
70:LN$(CU)=LN$(CU)+P$+STR$(N+1)+".)  "+"SAVE FILE TO DISK"+P1$
530 GOSUB 70
540 LN$(CU)=LN$(CU)+"PRINT"
550 FOR N=1 TO MI
560 NU=NU+IC%50:NU(N)=NU
570 NU$=NU$+STR$(NU)+","
580 NEXT N
590 NU$=LEFT$(NU$,(LEN(NU$)-1))
600 GOSUB 70
610 LN$(CU)=LN$(CU)+"INPUT"+P1$+"ENTER CHOICE : "+P1$+";CH$"
620 GOSUB 70
630 LN$(CU)=LN$(CU)+"CH=VAL(CH$): IF CH<1 OR CH> "+STR$(MI)+" GOTO"+STR$(VAL(LN$(CU-1)))
640 GOSUB 70
650 LN$(CU)=LN$(CU)+"ON CH GOSUB"+NU$
660 GOSUB 70
670 LN$(CU)=LN$(CU)+"GOTO "+STR$(IM(1))

680 ' ****** INSERT REMARKS AT FUTURE MODULE LOCATIONS ******

690 FOR N=1 TO MI-IOFLAG
700 GOSUB 70
710 LN=NU(N):LN$(CU)=STR$(NU(N))+"   REM ****** INSERT "+MENU$(N)+" SUBROUTINE HERE "+" ******"
720 NEXT N
730 IF IOFLAG<>2 GOTO 1230
740 GOSUB 70
750 IF DI=0 AND MI=0 PRINT "SORRY, I NEED A STRING ARRAY DEFINED TO BR";A$:RUN
760 ' ****** CREATE DISK INPUT MODULE ******

770 IF MI=0 THEN LN$(CU)=LN$(CU)+"  REM ****** LOAD FILE FROM DISK":GOTO 790
780 LN=NU(N):LN$(CU)=STR$(NU(N))+"   REM ****** LOAD FILE FROM DISK ******"
790 GOSUB 70
800 LN$(CU)=LN$(CU)+"INPUT "+P1$+"ENTER FILE NAME :"+P1$+";F$"
810 GOSUB 70
820 LN$(CU)=LN$(CU)+" OPEN "+P1$+"I"+P1$+",1,F$"
830 GOSUB 70
840 LN$(CU)=LN$(CU)+" INPUT #1,NF"
850 GOSUB 70
860 LN$(CU)=LN$(CU)+"FOR N=1 TO NF"
870 GOSUB 70
880 IF DI=2 THEN LN$(CU)=LN$(CU)+"FOR COL=1 TO NC":GOSUB 70
890 LN$(CU)=LN$(CU)+"INPUT #1,DA$(N"
900 IF DI=2 THEN LN$(CU)=LN$(CU)+",COL)" ELSE LN$(CU)=LN$(CU)+")"
910 GOSUB 70
920 LN$(CU)=LN$(CU)+"NEXT"
930 IF DI=2 THEN LN$(CU)=LN$(CU)+" COL,N"
940 GOSUB 70
950 LN$(CU)=LN$(CU)+"CLOSE"
960 GOSUB 70
970 LN$(CU)=LN$(CU)+"RETURN"

980 ' ****** CREATE DISK OUTPUT MODULE ******

990 GOSUB 70
1000 IF MI=0 THEN LN$(CU)=LN$(CU)+"   REM ****** SAVE FILE TO DISK ******":GOTO 1020
1010 LN=NU(N+1):LN$(CU)=STR$(NU(N+1))+"   REM ****** SAVE FILE TO DISK ******"
1020 GOSUB 70
1030 LN$(CU)=LN$(CU)+"INPUT "+P1$+"ENTER FILE NAME :"+P1$+";F$"
```

```
ENTER MENU CHOICE #  3
? ACCESS DATA FILE←


DO YOU WANT A 'CLEAR SCREEN' SUBROUTINE? YES
DO YOU WANT AN 'INKEY$-INPUT' SUBROUTINE? YES



ENTER THE NAME OF THIS PROGRAM? MAGAZINE/BAS←


100  CLEAR MEM/3*2
110  DIM DA$( 40, 5)
120  NC= 5
130  CLS:PRINT:  PRINT "        **********  MENU **********":PRINT
140    PRINT "       1.)   ENTER NEW MAGAZINES"
150    PRINT "       2.)   UPDATE EXISTING MAGAZINES"
160    PRINT "       3.)   ACCESS DATA FILE"
170    PRINT "       4.)  LOAD FILE FROM DISK"
180    PRINT "       5.)  SAVE FILE TO DISK"
190  PRINT
200  INPUT"ENTER CHOICE : ";CH$
210  CH=VAL(CH$): IF CH<1 OR CH>  5 GOTO 200
220  ON CH GOSUB 500, 1000, 1500, 2000, 2500
230  GOTO  130
500   REM ****** INSERT ENTER NEW MAGAZINES SUBROUTINE HERE  ******
1000   REM ****** INSERT UPDATE EXISTING MAGAZINES SUBROUTINE HERE  ******
1500   REM ****** INSERT ACCESS DATA FILE SUBROUTINE HERE  ******
2000   REM ****** LOAD FILE FROM DISK ******
2010   INPUT "ENTER FILE NAME :";F$
2020    OPEN "I",1,F$
2030    INPUT #1,NF
2040   FOR N=1 TO NF
2050   FOR COL=1 TO NC
2060   INPUT #1,DA$(N,COL)
2070   NEXT COL,N
2080   CLOSE
2090   RETURN

2500   REM ****** SAVE FILE TO DISK ******
2510  INPUT "ENTER FILE NAME :";F$
2520   OPEN "O",1,F$
2530   PRINT #1,NF
2540  FOR N=1 TO NF
2550  FOR COL=1 TO NC
2560  PRINT #1,DA$(N,COL);","
2570  NEXT COL,N
2580  CLOSE
2590  RETURN
2600     REM ****** CLEAR SCREEN SUBROUTINE ******
2610  CLS:PRINT:PRINT:RETURN
2620    REM ****** INKEY$ INPUT SUBROUTINE *****
2630  A$=INKEY$:IF A$="" GOTO  2630
2640  A=VAL(A$)
2650  RETURN
```

A Critical Path Method of Project Control

continued from page 107

Figure 1. Activity report for demonstation project network

SN	EN	DUR	DESCRIPTION	EARLY-ST	EARLY-FN	LATE—ST	LATE—FN	ACT/PL-FN	FLOAT	RESP	AUX-1	AUX-2	STATUS
				BUDGETED			ACTUAL		VARIANCE				
				MATERIAL	LABOR	BURDEN	MATERIAL	LABOR	BURDEN	MATERIAL	LABOR	BURDEN	
1	10	3	THIS IS THE REQUIRED ACTIVITY TO START A NETWORK	03/15/81	03/18/81	03/15/81	03/18/81		0	YOU	1	0	CRITICAL PAST DUE
				$100.00	$100.00	$250.00	$0.00	$0.00	$0.00	$100.00	$100.00	$250.00	
10	20	6	A STANDARD DEPENDENCY	03/18/81	03/26/81	03/18/81	03/26/81		0	YOU	2	0	CRITICAL PAST DUE
				$100.00	$100.00	$250.00	$0.00	$0.00	$0.00	$100.00	$100.00	$250.00	
10	30	13	ONE MORE ACTIVITY	03/18/81	04/06/81	04/21/81	05/08/81		24	YOU	2	0	CAN START
				$360.00	$1200.00	$3000.00	$0.00	$0.00	$0.00	$360.00	$1200.00	$3000.00	
10	65	35	COULD HAVE BEEN 10-70 BUT I WANTED TO USE A DUMMY 65-70	03/18/81	05/06/81	04/09/81	05/29/81		16	YOU	1	0	MUST START
				$2000.00	$4580.00	$11450.00	$0.00	$0.00	$0.00	$2000.00	$4580.00	$11450.00	
20	35	13	I AM DEPENDENT ON YOU TO FINISH 10-20	03/26/81	04/14/81	03/26/81	04/14/81		0	ME	1	0	CRITICAL PAST DUE
				$200.00	$158.00	$395.00	$0.00	$0.00	$0.00	$200.00	$158.00	$395.00	
30	50	11	THIS IS MY FAVORITE TASK	04/06/81	04/21/81	05/08/81	05/26/81		24	ME	1	0	CAN START
				$100.00	$100.00	$250.00	$0.00	$0.00	$0.00	$100.00	$100.00	$250.00	
35	40	10	AN ACTIVITY OF 10 ELAPSED DAYS WITH 4 PERSONS ASSIGNED (AUX1)	04/14/81	04/28/81	04/14/81	04/28/81		0	YOU	4	0	CRITICAL MUST START
				$500.00	$2000.00	$5000.00	$0.00	$0.00	$0.00	$500.00	$2000.00	$5000.00	
40	50	19	A MAJOR INTER RELATIONSHIP	04/28/81	05/26/81	04/28/81	05/26/81		0	ME	3	0	CRITICAL
				$3600.00	$6000.00	$15000.00	$0.00	$0.00	$0.00	$3600.00	$6000.00	$15000.00	
40	70	5	JUST SOMETHING THAT MUST BE DONE BEFORE 70-100	04/28/81	05/05/81	05/21/81	05/29/81		17	ME	1	0	
				$250.00	$650.00	$1625.00	$0.00	$0.00	$0.00	$250.00	$650.00	$1625.00	
50	60	7	CAN NOT START UNTIL 35-40 IS COMPLETED	05/26/81	06/04/81	05/26/81	06/04/81		0	YOU	2	0	CRITICAL
				$200.00	$200.00	$500.00	$0.00	$0.00	$0.00	$200.00	$200.00	$500.00	
60	100	11	I CAN SEE THE LIGHT AT THE END OF THE TUNNEL	06/04/81	06/19/81	06/04/81	06/19/81		0	ME	1	0	CRITICAL
				$100.00	$100.00	$150.00	$0.00	$0.00	$0.00	$100.00	$100.00	$150.00	
70	100	15	WE'RE GETTING CLOSE TO THE END	05/06/81	05/28/81	05/29/81	06/19/81		16	ME	1	0	
				$500.00	$264.00	$396.00	$0.00	$0.00	$0.00	$500.00	$264.00	$396.00	

ACTIVITY REPORT FOR DEMONSTRATION PROJECT NETWORK

SN	EN	DUR	DESCRIPTION	EARLY-ST	EARLY-FN	LATE—ST	LATE—FN	ACT/PL-FN	FLOAT	RESP	AUX-1	AUX-2	STATUS
				BUDGETED			ACTUAL		VARIANCE				
				MATERIAL	LABOR	BURDEN	MATERIAL	LABOR	BURDEN	MATERIAL	LABOR	BURDEN	

```
10  20  A STANDARD DEPENDENCY              CCCCCCCCC
20  35  I AM DEPENDENT ON YOU  TO                CCCCCCCCCCCCCCCCCCCC
      FINISH 10-20
10  65  COULD HAVE BEEN 10-70 BUT I     FFFFFFFFFFFFFFFFFFFFAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAA
      WANTED TO USE A DUMMY 65-70


35  40  AN ACTIVITY OF 10 ELAPSED DAYS                  CCCCCCCCCCCCCC
      WITH 4 PERSONS ASSIGNED (AUX1)
10  30  ONE MORE ACTIVITY          FFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFAAAAAAAAAAAAAAAAAA
40  50  A MAJOR INTER RELATIONSHIP                  CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
30  50  THIS IS MY FAVORITE TASK              FFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFAAAAAAAAAAAAAAAAAA
40  70  JUST SOMETHING THAT MUST BE                  FFFFFFFFFFFFFFFFFFFFFFFFAAAAAAAAA
      DONE BEFORE 70-100
50  60  CAN NOT START UNTIL 35-40                                          CCCCCCCCCC
      IS COMPLETED
70  100 WE'RE GETTING CLOSE TO THE END                              FFFFFFFFFFFFFFFFFFFFFFAAAAAAAAAA
60  100 I CAN SEE THE LIGHT AT THE END                                             CCCC
      OF THE TUNNEL

          X....X....X....X....X....X....X....X....X....X....X....X....X....X....X....X....X....X....X....X....
          'F'=FLOAT    'A'=ACTIVITY    'C'=CRITICAL PATH    'X'=COMPLETE
```

Figure 3. AOA network

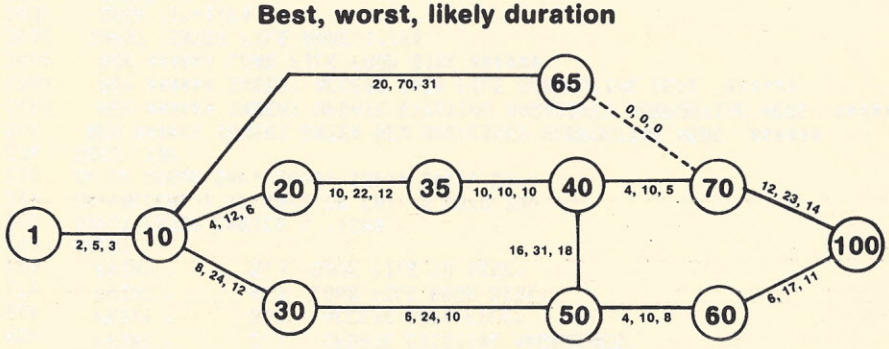

Figure 4. Main menu

```
MENU/CPM

                *** M E N U ***
          PROJECT MANAGEMENT SYSTEM
            NETWORKING OPTIONS 1-8
 1 >ADD< CREATE OR ADD TO AN EXISTING NETWORK (MAX 500)
 2 >UPD< CHANGE OR DELETE A TASK IN AN EXISTING NETWORK
 3 >CAL< CALCULATE ALL START/STOP DATES FOR A NETWORK
 4 >RPT< REPORT ALL TIME AND COST CONDITIONS
 5 >BAR< PRINT A GANTT CHART FOR A NETWORK
 6 >CLD< MAINTAIN UPTO 100 OMITTED DATES FROM PLANNING
```

```
FINAL TOTAL=  $8010.00 $15452.00 $38266.00       $0.00     $0.00     $0.00     $8010.00 $15452.00 $38266.00

TOTAL ACTUAL COST =      $0.00
TOTAL PAYMENTS    =   $1500.00
                      ---------
OVER / UNDER      =   $1500.00

      START DATE : 03/15/81                    PROJECT MGR : AL VANDERPOOL
      CUSTOMER : LUCKY PROJECTS INC.           LAST PAYMENT DATE : 04/03/81
      DAYS PER WEEK : 5                        BURDEN % :  150

                    HOLIDAYS OMITTED
              STARTS   LENGTH     DESCRIPTION

              05/25/81    1       MEMORIAL DAY
              09/07/81    1       LABOR DAY
              11/26/81    2       THANKSGIVING
              12/25/81    2       CHRISTMAS
              01/01/82    1       NEW YEARS DAY
```

Figure 2. Gantt chart

```
                                        DEMONSTRATION PROJECT NETWORK
                                        0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0
                                        6  6  6  6  6  7  7  7  7  7  7  8  8  8  8  8  8  8  8
                                        /  /  /  /  /  /  /  /  /  /  /  /  /  /  /  /  /  /  /
                                        0  1  1  2  2  0  0  1  1  2  2  0  0  1  1  2  2  2  7
                                        8  3  8  3  8  3  8  3  8  3  8  2  7  2  7  2  7  2  7
SN   EN  ----------DESCRIPTION----------  X...X...X...X...X...X...X...X...X...X...X...X...X...X...X...X...X...X...X...X...X...X...X...X...X...X...
  1   10  THIS IS THE REQUIRED ACTIVITY
        TO START A NETWORK
 10   20  A STANDARD DEPENDENCY
 20   35  I AM DEPENDENT ON YOU  TO
        FINISH 10-20
 10   65  COULD HAVE BEEN 10-70 BUT I
        WANTED TO USE A DUMMY 65-70
 35   40  AN ACTIVITY OF 10 ELAPSED DAYS
        WITH 4 PERSONS ASSIGNED (AUX1)
 10   30  ONE MORE ACTIVITY
 40   50  A MAJOR INTER RELATIONSHIP
 30   50  THIS IS MY FAVORITE TASK
 40   70  JUST SOMETHING THAT MUST BE
        DONE BEFORE 70-100
 50   60  CAN NOT START UNTIL 35-40
        IS COMPLETED
 70  100  WE'RE GETTING CLOSE TO THE END   AAAAAAAAAAA
 60  100  I CAN SEE THE LIGHT AT THE END   CCCCCCCCCCC
        OF THE TUNNEL

                                        X...X...X...X...X...X...X...X...X...X...X...X...X...X...X...X...X...X...X...X...X...X...X...X...X...X...
                                         'F'=FLOAT    'A'=ACTIVITY    'C'=CRITICAL PATH    'X'=COMPLETE

                                        DEMONSTRATION PROJECT NETWORK
                                        0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0
                                        3  3  3  3  4  4  4  4  4  4  5  5  5  5  5  5  6
                                        /  /  /  /  /  /  /  /  /  /  /  /  /  /  /  /  /
                                        1  2  2  3  0  0  1  1  2  2  0  0  1  1  2  2  0
                                        5  0  5  0  4  9  4  9  4  9  4  9  4  9  4  9  3
SN   EN  ----------DESCRIPTION----------  X...X...X...X...X...X...X...X...X...X...X...X...X...X...X...X...X...X...X...X...X...X...X...X...X...X...
  1   10  THIS IS THE REQUIRED ACTIVITY   CCCC
        TO START A NETWORK
```

```
 7 >INQ< DISPLAY OR PRINT ALL ACTIVE NETWORK NAMES
 8 >MIN< ADD/UPD/CAL/RPT A UNIT LEVEL NETWORK

          UTILITY  OPTIONS 9-12
 9 >INT< MUST BE RUN FIRST FOR EACH OPERATING SESSION
10 >RCV< REUSE SPACE CREATED WHEN AN ACTIVITY WAS DELETED
11 >DEL< DELETE AN ENTIRE NETWORK ----- CAUTION -----
12 >EXT< RETURN TO TRSDOS
          OPTION #?....

 PROJECT NUMBER ?.........      DRIVE NUMBER :X ?....
```

Figure 5. Screens for adding and updating information

```
2.ADD HEADING INFORMATION

                    NWXXXXXX/NET:0
                      *** A D D ***
          PROJECT CONTROL INFORMATION FOR A NEW NETWORK
------------------------------ TITLE OF NETWORK ------------------------------


          START DATE OF PROJECT      BURDEN %
          FORM MMDDYY ?.......        ?.....

-- PROJECT MANAGER--        PASSWD     ----------CUSTOMER----------


               CONTROL RECORD WRITTEN AS ENTERED

3.ADD DETAIL INFORMATION

          YOU CURRENTLY CAN ADD  NNN  ACTIVITIES
                    NWXXXXXX/NET:0
                      *** A D D ***
              DETAIL INFORMATION FOR A NETWORK

     SNODE     ENODE     ---------DESCRIPTION--------
     ?.....    ?.....    ?.............................
                         ?.............................
  DURATION  BEST   WORST  LIKELY  PLANNED FINISH  PLANNED COSTS
                                                    MATERIAL-?.....
                                                    LABOR----?.....
          RESPONSIBILITY ?...                       BURDEN---?.....
          AUX1...1-32767...AUX2
          ?.....          ?.....


 OK TO SAVE???    Y=SAVE    D=DELETE   ?Y
```

Figure 5 continued on next page

```
4, UPDATE HEADER INFORMATION

                    NWXXXXXX/NET:0
                       *** U P D ***
          PROJECT CONTROL INFORMATION FOR NETWORK
          ---------- TITLE OF NETWORK ----------------------------------

               START DATE OF PROJECT     BURDEN %
               FORM MMDDYY ........      ...%

          -- PROJECT MANAGER--    PASSWD   ----------CUSTOMER----------

                LAST PAID DATE     AMOUNT PAID TO DATE

               1=TITLE          2=START DATE        3=BURDEN %
               4=PROJ MGR       5=PASSWRD           6=CUSTOMER
               7=PAY DATE       8=PAYMENT           9=END CHANGES
               10=NO CHANGES
                   ENTER NUMBER OF FIELD TO CHANGE ?..
          ENTER NEW XXXXXX
          ?

5, UPDATE DETAIL INFORMATION

               YOU CURRENTLY HAVE NNN ACTIVITIES IN NETWORK
                         NWXXXXXX/NET:0
                            *** U P D ***
                    CHANGE INFORMATION FOR AN ACTIVITY

          SNODE   ENODE  ----------DESCRIP*TION----------
          ?...    ?....
             DURATION BEST  WORST  LIKELY   PLANNED FINISH    ACTUAL FINISH

             RESPONSIBILITY          PLANNED COST     ACTUAL COST
                                                MAT
                                                LAB
                   AUX1       AUX2              BUR

               1=DESCRIPTION          2=DURATION       3=PLANNED FINISH
               4=ACTUAL FINISH        5=RESPONSIBILITY 6=PLANNED COST
               7=ACTUAL COST          8=AUX1           9=AUX2
               10=IN PROCESS          11=DELETE THIS TASK--BE CAREFUL !!!!!!
               12=CHANGE COMPLETED    13=END OF UPDATE 14=SCAN

                   ENTER NUMBER OF FIELD TO CHANGE ?....
          ENTER NEW XXXXXXXX
          ?
```

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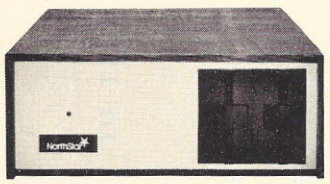

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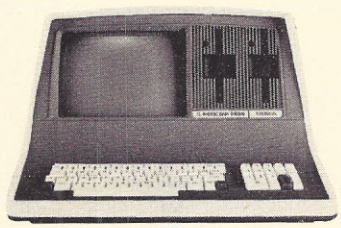

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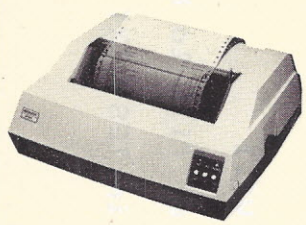

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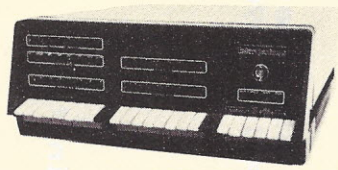

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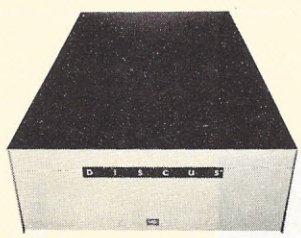

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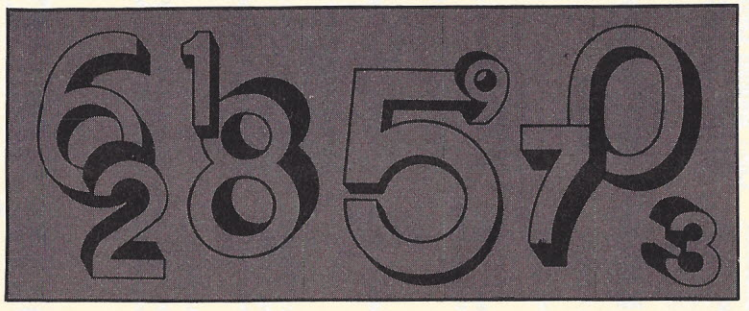
Word Count

continued from page 112



Sample run

```
+LIST TEST

This is a sample text file.  Its purpose
is to show how the word count program
works.  The actual word count of this
file is 26.


READY

LOAD "WORD"


READY

RUN

Word Count V1.1

Enter name of file to be processed? TEST.TXT

 26  words in TEST.TXT


READY
```

Program listing

```
 10 REM WORD COUNT  SSC  1-80
 20 BP=1
 30 PRINT "Word Count V1.1"
 40 PRINT
 50 PRINT "Enter name of file to be processed";
 60 INPUT F$
 70 ON ERROR GOTO 300
 80 OPEN OLD F$ AS 1
 90 GOSUB 190:REM set character
100 IF C$=" " THEN IN=0:GOTO 90
110 IF IN<>0 THEN 90
120 IN=1
130 CT=CT+1
140 GOTO 90
150 PRINT
160 PRINT CT;" words in ";F$
170 CLOSE 1
180 END
190 REM set character subroutine
200 IF BP>LEN(B$) THEN 250
210 IF BP<LEN(B$) THEN 270
220 C$=" ":REM return blank for EOL
230 BP=BP+1
240 RETURN
250 BP=0
260 INPUT LINE #1,B$
270 BP=BP+1
280 C$=MID$(B$,BP,1)
290 RETURN
300 IF ERR=8 THEN RESUME 150
310 IF ERR<>4 THEN 360
320 PRINT "File not found"
330 CLOSE 1
340 RESUME 40
350 PRINT
360 PRINT "Error ";ERR;" in line ";ERL
370 END

READY
```

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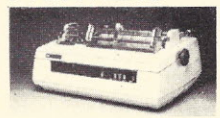

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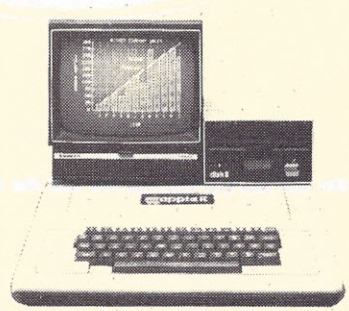

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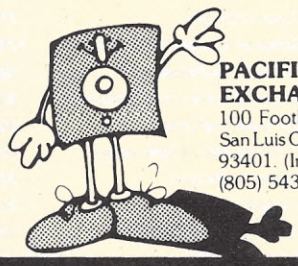

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*Manufacturer requests factory direct inquiry.

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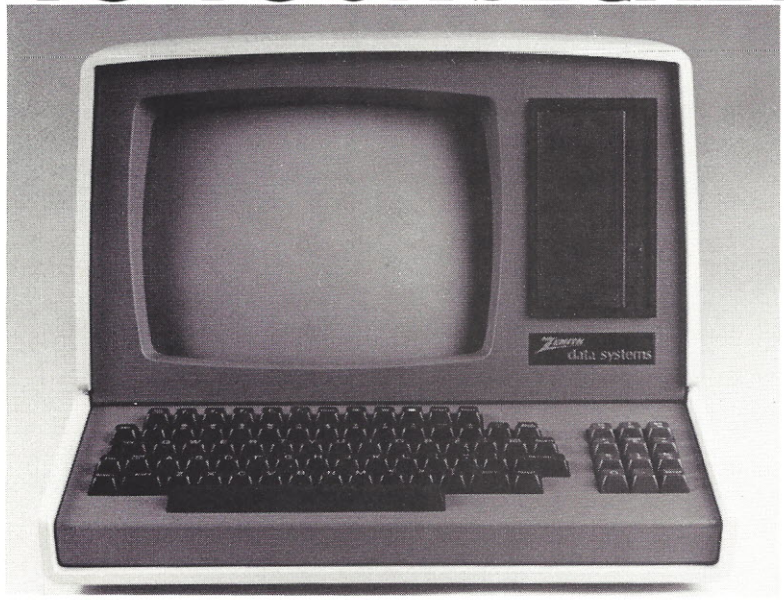
THE MOST INCREDIBLE LITTLE WORKER NEXT TO YOUR SECRETARY CAN SIT RIGHT NEXT TO YOUR SECRETARY.



The Zenith Z89 sub-compact: a dual Z80 microcomputer, a video terminal, and a floppy-disk drive . . . all in a single, desktop stand-alone.

The Z89: a subcompact microcomputer that needs about as much space on a desk as a portable TV set.

And needs about as much technical training to operate. Because the Z89 uses the industry-standard CP/M ™ operating system, it accepts a vast variety of existing software. Most microcomputer programmers already know it, and anyone trained on larger systems adapts to CP/M* in a flash. The Z89 also uses standard, currently available software on both 5¼" and 8" floppy disks, yet is capable of more sophisticated operation using extended languages such as Microsoft BASIC, COBOL, FORTRAN, and PASCAL.

The keyboard follows the standard typewriter format, with every touch of a key confirmed by an audible click. Numbers are duplicated in calculator format, with up to 18 decimal-place accuracy. And the large-capacity non-glare video display is easy on the eyes.

The Z89 is a sub-compact desktop unit with a memory of up to 64K bytes of RAM—more than enough for word processing, accounts payable, accounts receivable, inventory control, and many other business, scientific, and technical applications . . . without a zillion different cords hanging out of the back.

And now, for you tech-spec freaks, some important jargon regarding standardization and flexibility:

Disk data: Choice of internal or external storage, or combination; 100K to 2.5 megabytes. 5¼" flexible drives (standard 10-sector hard-sector media, single-side single-density) for lowest media cost. 8" disk drives (double-side double-density) for greater storage; also standard IBM single-side single-density format for exchanging data with other computer systems. Available in either 48K or 64K systems.

Zenith is a boot-loaded RAM system, so it can accommodate the latest software on the market, and anything new that's likely to come along in the future. Twin serial input/output ports let you interface with just about any printer or modem on the market—handy whether you already have them now, or want to add them in the future. And with five different Zenith models, from a basic 48K no-disk-drive, to built-in 5¼" or 8" single or double disc drives, you can put together 18 different configurations . . . which means you can design a system to fit your exact job, rather than force your job to fit a system. In other words, the Z89's capabilities make the microcomputers with the cute names look like toys

Service? Available just about everywhere.

The Zenith Z89 . . . a highly reliable, highly affordable, state-of-the art microcomputer for the state of your business—whatever its size.

For the name of your nearest dealer, give us a call.

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CIRCLE INQUIRY NO. 49

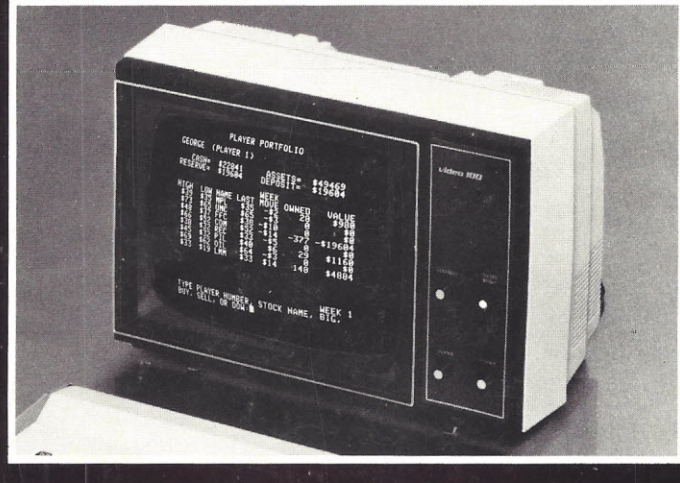
AMDEK

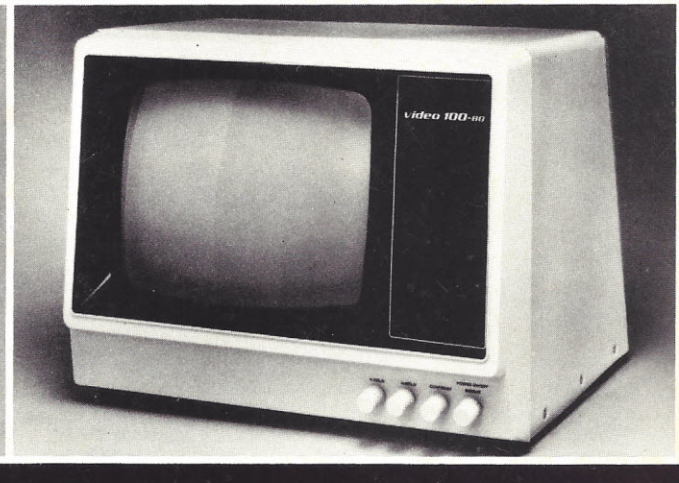
Professional Color & B/W Monitors

NEW 13″ COLOR

The Amdek 13″ Color Video Monitor is ideal for all personal and business computing applications. Bright jitter-free text allows viewing over extended periods without causing eye fatigue, especially in word processing applications. The low resolution display provides 40 characters wide by 24 characters deep with 260 horizontal lines and 300 vertical lines.

This compact, lightweight monitor (only 25 lbs.) has a molded-in carrying handle, making it easy to move. Its industrial grade construction and shatter resistant case provide reliable service in both office and industrial environments. All front mounted controls make it easily adjustable at a glance without the loss of a single keystroke.





VIDEO 100 12″ B/W MONITOR

This highly reliable 12″ black and white monitor features a 12MHz band width and 80 character by 24 line display. Plug-in compatibility with Apple, Atari, Radio Shack, O.S.I., Micro-Term and Exidy make this the perfect text display for almost any system.

VIDEO 100-80 12″ B/W MONITOR

The model 80 features an industrial grade metal cabinet with built-in disk mounting capability and space for an 11″ x 14″ PC board for custom designed electronics. Front mounted controls include power, contrast, horizontal hold, vertical hold, and brightness.

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